DOCUMENT RESUME

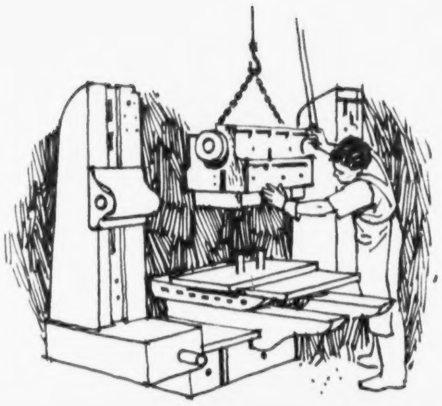
ED 064 074 SE 013 576

TITLE	Research and Development in Industry, 1969.
INSTITUTION	National Science Foundation, Washington, D.C.
REPORT NO	NSF-71-18
PUB DATE	Apr 71
NOTE	108p.
AVAILABLE FROM	Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (Stock No. 3800-0100 $1.00)
EDRS PRICE	MF-$0.65 HC-$6.58
DESCRIPTORS	*Financial Support; Industry; *Research and Development Centers; *Research Needs; Resource Materials; Scientific Research; *Surveys; Technology
IDENTIFIERS	National Science Foundation

ABSTRACT

This report, the 15th in a series extending back to 1953, presents the results of a 1969 National Science Foundation survey of industrial research and development. The data obtained are designed to provide information useful to government officials, legislators, and other individuals concerned with evaluating the role of research and development in furthering the national welfare and in the allocation of scientific resources. (Author/CP)

ED 054074



U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
OFFICE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY

Research and Development in Industry

1969

Funds, 1969
Scientists & Engineers
January 1970

Surveys of Science
Resources Series
NATIONAL SCIENCE FOUNDATION
NSF 71-18

1

Research and Development in Industry

1969

Funds, 1969
Scientists & Engineers
January 1970

Surveys of Science
Resources Series

NATIONAL SCIENCE FOUNDATION

NSF 71-18

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20024 - Price $1
Stock Number 3800-0100

FOREWORD

IN RECENT YEARS, the national investment in research and development has been growing, but at a slower rate than in the fifties and early sixties. Despite this R&D slowdown, industrial R&D support has been the major influence behind the growth of research and development. It is uncertain, particularly in view of the recent economic slowdown, whether industrial R&D spending will continue to post significant gains. Yet, industrial research and development seems more important than ever for the Nation's economic welfare.

At present, industrial research and development is undergoing a noticeable change. Although primary emphasis still focuses on the traditional objectives of achieving customer satisfaction, improving profitability through new and improved products and processes, and servicing the Nation's defense and space programs, an additional element, though still relatively modest in size is becoming increasingly important—research and development in the area of the Nation's mounting social and environmental problems. This research and development is not only directed toward alleviating our current difficulties, but is also attempting to identify and minimize adverse effects which may accompany future scientific and technological advances.

The National Science Foundation both conducts and sponsors surveys in the various sectors of the economy to better understand changes in R&D emphasis, as well as to measure the growth, magnitude, and other characteristics of research and development. The data obtained from these surveys are published by the Foundation and are designed to provide information useful to Government offiicals, legislators, and other individuals concerned with evaluating the role of research and development in furthering the national welfare and in the allocation of scientific resources.

This report presents the results of the 1969 survey of industrial research and development and is the 15th in a series extending back to 1953. The report was prepared in the Office of Economic and Manpower Studies, Thomas J. Mills, Head. Data contained in the survey were collected and compiled by the Bureau of the Census, U.S. Department of Commerce, under the general direction of Owen C. Gretton, Chief, Industry Division.

The National Science Foundation and the Bureau of the Census gratefully acknowledge the cooperation of the numerous organizations that provided data for this study.

CHARLES E. FALK
Director, Division of
Science Resources and Policy Studies

APRIL 1971

ACKNOWLEDGMENTS

Within the National Science Foundation, this report was prepared by Marian Mieremet, Robert O. Santos, and John R. Chirichiello under the supervision of Thomas J. Hogan, Study Director, Industry Studies Group and the general direction of Kenneth Sanow, Head, Statistical Surveys and Reports Section, Office of Economic and Manpower Studies, Division of Science Resources and Policy Studies.

Within the Bureau of the Census, U.S. Department of Commerce, the 1969 survey of industrial research and development was supervised by Louis J. Owen, Assistant Chief for Production and Process Statistics, Industry Division, assisted by Richard Bell. Jack L. Ogus, Assistant Chief, Statistical Research and Methodology, assisted by Donald F. Clark, served as statistical consultant for the project.

CONTENTS

Page

FOREWORD iii

HIGHLIGHTS vii

INTRODUCTION xi

GENERAL CHARACTERISTICS 1
- R&D Funds 1
- Employment of R&D Scientists and Engineers 5
- Distribution of R&D Funds, by Size of Company and R&D Program 6
- Distribution of R&D Funds, by Major Type of Cost 8
- Basic Research, Applied Research, and Development 10
- Geographic Distribution of R&D Funds 12
- R&D Funds Related to Employment and Net Sales 14

APPENDIXES:

- A. Technical Notes 19
- B. Statistical Tables 27
- C. Covering Letters, Questionnaire, and Instructions 85

6

HIGHLIGHTS

Industrial research and development , 1969

R&D funds $18.5 billion →

By industry	
Aircraft & missiles	31%
Electrical equipment	23%
Chemicals	9%
Machinery	9%
Motor vehicles	9%
Other	19%

By source	
Company	53%
Federal	47%

Basic research funds $646 million →

By field of science	
Physical	52%
Engineering	27%
Life	12%
Environmental	2%
Other	7%

Applied research and development funds $17.8 billion →

By product field	
Guided missiles and spacecraft	21%
Electrical equipment	19%
Aircraft parts	14%
Machinery	9%
Chemicals	9%
Other	28%

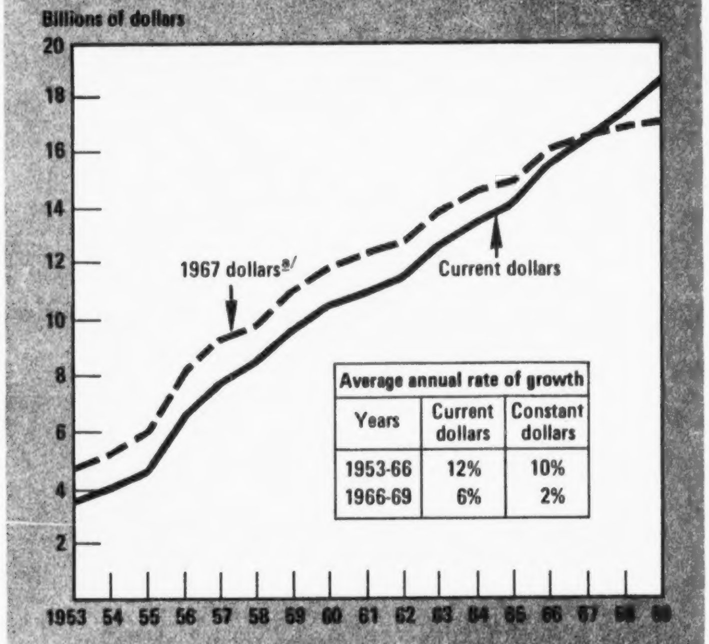
Scientists and engineers 383,200 →

By source of support	
Company	60%
Federal	40%

Source: National Science Foundation

- In 1969 industry spent $18.5 billion for research and development. This was 6 percent above the 1968 level of $17.5 billion and 5 times the amount spent on these activities in 1953. The 1968–69 change was due solely to increases in companies' own funds.

Funds for industrial R&D performance, 1953–69



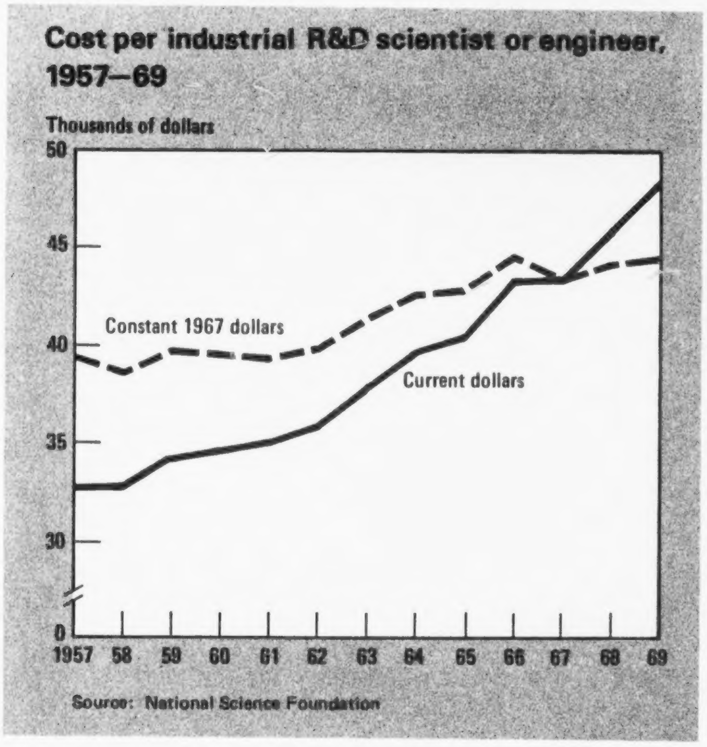
Average annual rate of growth		
Years	Current dollars	Constant dollars
1953-66	12%	10%
1966-69	6%	2%

a/ The implicit price deflator for the gross national product has been used to convert from current to constant dollars.

Source: National Science Foundation

- Between January 1969 and January 1970 the full-time-equivalent (FTE) number of R&D scientists and engineers employed by industrial firms dropped from 387,100 to 380,600. This was the first decline recorded in this 13-year series, and was primarily accountable to cutbacks in personnel working on Federal R&D programs. Recent employment data indicate a continuation of this decline.

- Almost all of the decline in employment of R&D scientists and engineers occurred in the aircraft and missiles industry, primarily reflecting cutbacks in National Aeronautics and Space Administration (NASA) programs. The number of R&D professionals working on Department of Defense (DOD) programs remained about level between 1968 and 1969.


Cost per industrial R&D scientist or engineer, 1957–69

Source: National Science Foundation

- In 1969 there were 26 R&D scientists and engineers for every 1,000 employees in R&D-performing companies, down from 30 in 1964 and 1965.

- The cost per R&D scientist or engineer amounted to $48,200 in 1969, up 19 percent over the 1965 figure. If measured in constant dollars, there has been essentially no increase over the entire 4-year period.

- The Federal Government was the source of 47 percent of the R&D dollars spent by industrial firms during 1969. This ratio is down from the 1959 high of 59 percent.

- DOD and NASA furnished 89 percent of the Federal R&D funds to industry in 1969. In addition, these two agencies supported 89 percent of the industrial scientists and engineers working on Federal programs at an average annual cost of $56,200 per R&D professional.

- In 1969 industry financed 53 percent of its R&D efforts with its own funds. This is an increase from 41 percent in 1959.

- The four companies with the largest R&D programs in 1969 accounted for 19 percent of all industrial research and development that year. These same companies accounted for 7 percent of the sales and 8 percent of the employment of all R&D-performing manufacturing companies.

- In 1969 R&D-performing manufacturing companies spent an average of 4.0 percent of their net sales on R&D activities, the same ratio as in 1968 but down from 4.6 percent in 1964.

- The Pacific States led in R&D performance in 1969 with 27 percent of the total. The Middle Atlantic and East North Central States followed with 23 percent and 19 percent, respectively.

- Industry allocated 3 percent of its 1969 R&D funds to basic research. Over one-half of this amount was spent on the physical sciences.

- Applied research and development spending by industry amounted to $17.8 billion in 1969. Five product fields—guided missiles and spacecraft, electrical equipment, aircraft and parts, machinery, and chemicals—made up over 70 percent of this amount.

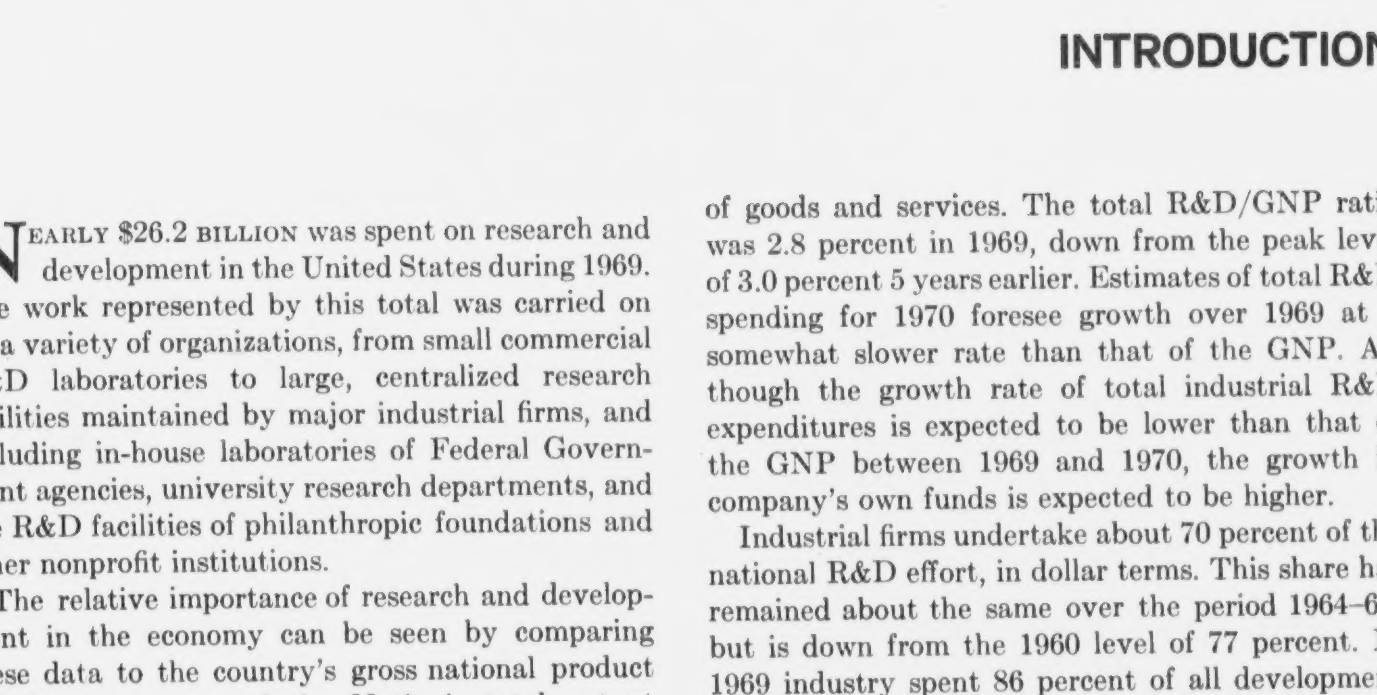
INTRODUCTION

Nearly $26.2 billion was spent on research and development in the United States during 1969. The work represented by this total was carried on by a variety of organizations, from small commercial R&D laboratories to large, centralized research facilities maintained by major industrial firms, and including in-house laboratories of Federal Government agencies, university research departments, and the R&D facilities of philanthropic foundations and other nonprofit institutions.

The relative importance of research and development in the economy can be seen by comparing these data to the country's gross national product (GNP), a measure of the Nation's total output of goods and services. The total R&D/GNP ratio was 2.8 percent in 1969, down from the peak level of 3.0 percent 5 years earlier. Estimates of total R&D spending for 1970 foresee growth over 1969 at a somewhat slower rate than that of the GNP. Although the growth rate of total industrial R&D expenditures is expected to be lower than that of the GNP between 1969 and 1970, the growth in company's own funds is expected to be higher.

Industrial firms undertake about 70 percent of the national R&D effort, in dollar terms. This share has remained about the same over the period 1964–69, but is down from the 1960 level of 77 percent. In 1969 industry spent 86 percent of all development funds, about the same as the 1960 ratio.

R&D/GNP[a]



[a] 1970 estimate from *National Patterns of R&D Resources, 1953-71 (NSF 70-46).*

Source: National Science Foundation

Research spending by industrial firms experienced a relative decline during the sixties. In 1960 industry performed 28 percent of the country's basic research effort; by 1969 this had fallen to 17 percent. Over the same period industry's applied research share slipped from 66 percent to 59 percent. Although industrial research spending has increased at a slower rate than the overall national gain, there has been a substantial rise in absolute terms. Between 1960 and 1969 industrial basic research expenditures increased from $376 million to $646 million. A number of companies have established extensive research facilities designed to keep industry in the forefront of scientific advancement. The vast majority of this research, however, is directed toward areas related to current or potential product lines.

This report covers R&D expenditures for 1969 and professional manpower in January 1970. The 1969 survey covered substantially fewer companies than in previous years. The sample was restricted to the approximately 1,200 companies with R&D programs of $200,000 or more. These firms account for about 98 percent of all industrial R&D performance. The 1968 survey obtained data from approximately 2,400 companies. In the statistical tables, the companies previously included in the sample, but excluded for 1969, were carried forward at their 1968 R&D performance levels. If these companies were moved forward into 1969 based on their average change over the preceding 5 years, the R&D totals would be increased by less than 0.05 percent. See the technical notes for additional detail.

This survey does not cover a few organizations, such as trade associations, which are estimated to account for less than 1 percent of the Nation's annual volume of industrial R&D performance funds. Although trade associations are nonprofit organizations, their primary mission is to serve industry.

R&D: Industrial vs. Product Classification

This report presents industrial R&D data on two different bases. First, appendix tables B–1 through B–35 and B–43 through B–56 furnish total R&D data on the traditional industry basis for the years 1953 to 1969. The second approach, in appendix tables B–36 through B–42, presents the applied research and development data on a product basis for 1959 to 1969. Because of its generalized nature, basic research cannot readily be classified by product field; instead, these data are classified by field of science.

GENERAL CHARACTERISTICS

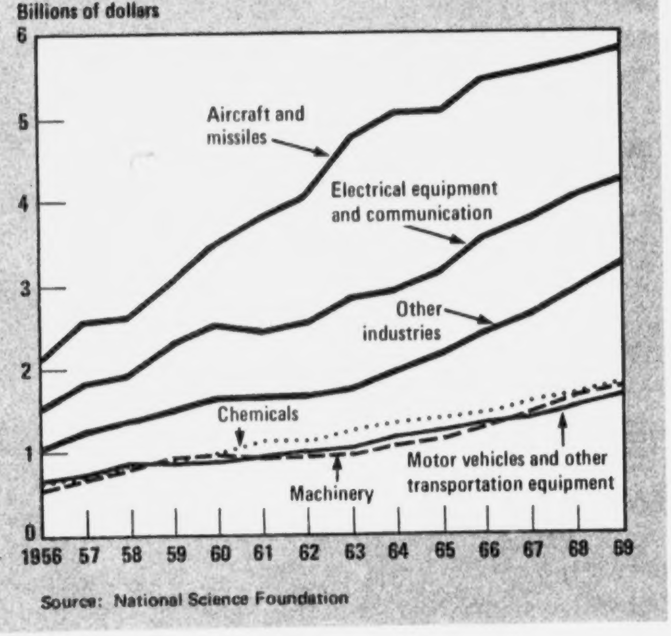
R&D Funds

Industrial spending for research and development reached a level of $18.5 billion during 1969, $1 billion more than in 1968. Over the past decade, industrial R&D funds have increased at the rate of 7 percent a year. In constant dollars, this increase has been 4 percent per year.

Leading industries

Over one-half of the industrial R&D funds are spent by companies in two industries—aircraft and missiles and electrical equipment and communication. In 1969, these two industries accounted for 55 percent of the industrial R&D total with the former industry spending $5.8 billion and the latter $4.3 billion. The high level of R&D expenditures in these industries results primarily from the large volume of Federal contract work.

Funds for R&D performance, by industry, 1956–69



Source: National Science Foundation

During 1969, firms in three other industries—chemicals and allied products, machinery, and motor vehicles and other transportation equipment—accounted for an additional 28 percent of the industrial R&D total. Most of the R&D effort in these industries was financed with companies' own funds. All other industries combined accounted for the remaining 17 percent of the total with no one industry spending more than 4 percent of the total.

Size of companies

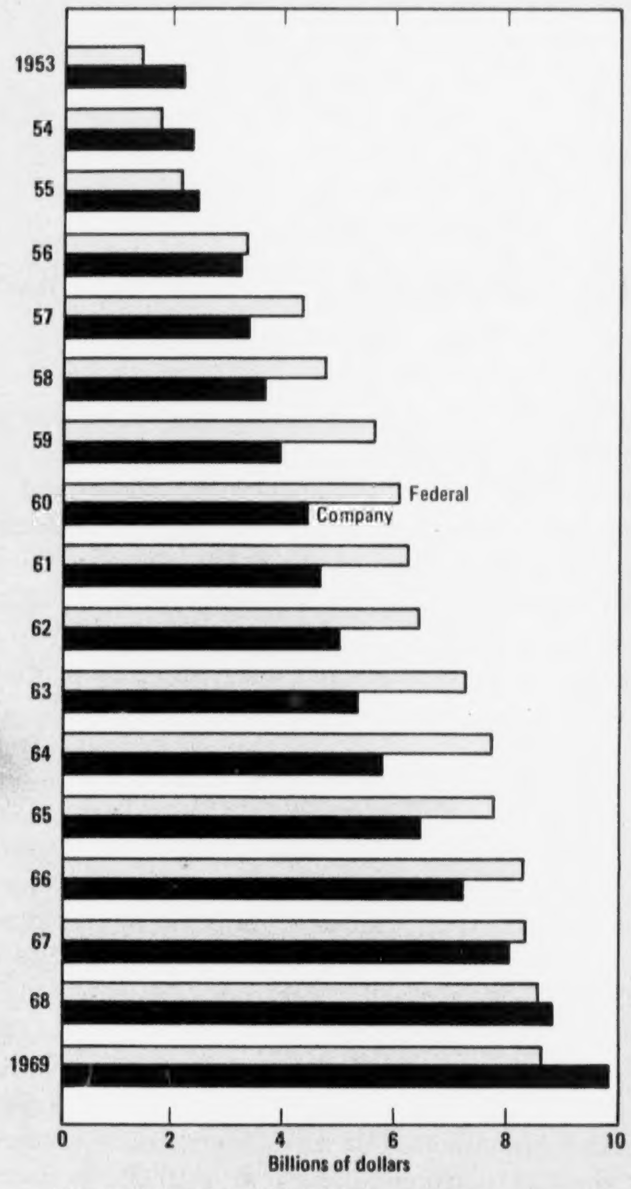
In 1969 companies with 10,000 or more employees conducted 85 percent of the research and development performed in industry. This ratio, however, was only equaled or exceeded in 5 industries—machinery, 85 percent; electrical equipment, 88 percent; petroleum, 93 percent; motor vehicles, 98 percent; and aircraft, 98 percent. In the nonmanufacturing industries where most of the R&D performance is conducted by small firms, only 5 percent was conducted by companies with 10,000 or more employees. For all other industries combined, slightly more than two-thirds of the research and development was performed by companies in this size-class.

Federal share

The Federal Government financed 47 percent of the R&D work performed in industry during 1969. This amounted to $8.6 billion and was the same amount as in 1968.

Nearly 80 percent of the Federal share in 1969 went to companies in the aircraft and electrical equipment industries. This ratio is about the same as 10 years ago but down slightly from a high of 84 percent in 1963. Firms in these two industries were the only ones to finance over one-half of their R&D effort with Federal funds.

Federal and company share of industrial R&D spending, 1953–69



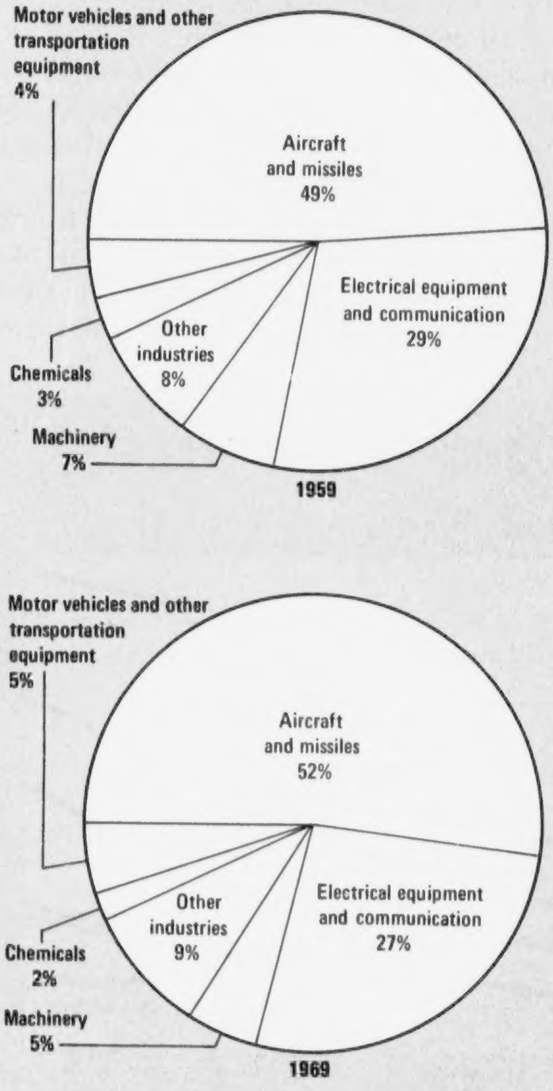
Source: National Science Foundation

Data on federally financed R&D performance presented in this report differ from data in *Federal Funds for Research, Development, and Other Scientific Activities*[1] in that data in this report represent expenditures primarily for the calendar year while data in *Federal Funds* represent obligations for the fiscal year. In addition, certain Government agencies, such as NASA, reporting for *Federal Funds* attribute their entire costs to research and development, whereas firms supplying off-the-shelf items to these agencies consider these to be routine sales and not connected with research and development.

Federally Funded Research and Development Centers (FFRDC's) are organizations administered by industrial firms, universities and colleges, or other nonprofit institutions. These organizations perform R&D work almost exclusively for Federal agencies. R&D expenditures of industry - administered FFRDC's are classified with those of the administering company.

R&D effort in industry-administered FFRDC's amounted to $464 million in 1969, 12 percent above the 1968 level. Basic research increased from $35 million to $37 million. Applied research amounted to $95 million in 1969, $8 million over the 1968 figure. Development increased from $293 million to $332 million between 1968 and 1969. In January 1970 there were 7,337 FTE R&D scientists and engineers in these centers, while 7,214 were employed in January 1969.

Distribution of Federal R&D spending in industry, 1959 and 1969



Source: National Science Foundation

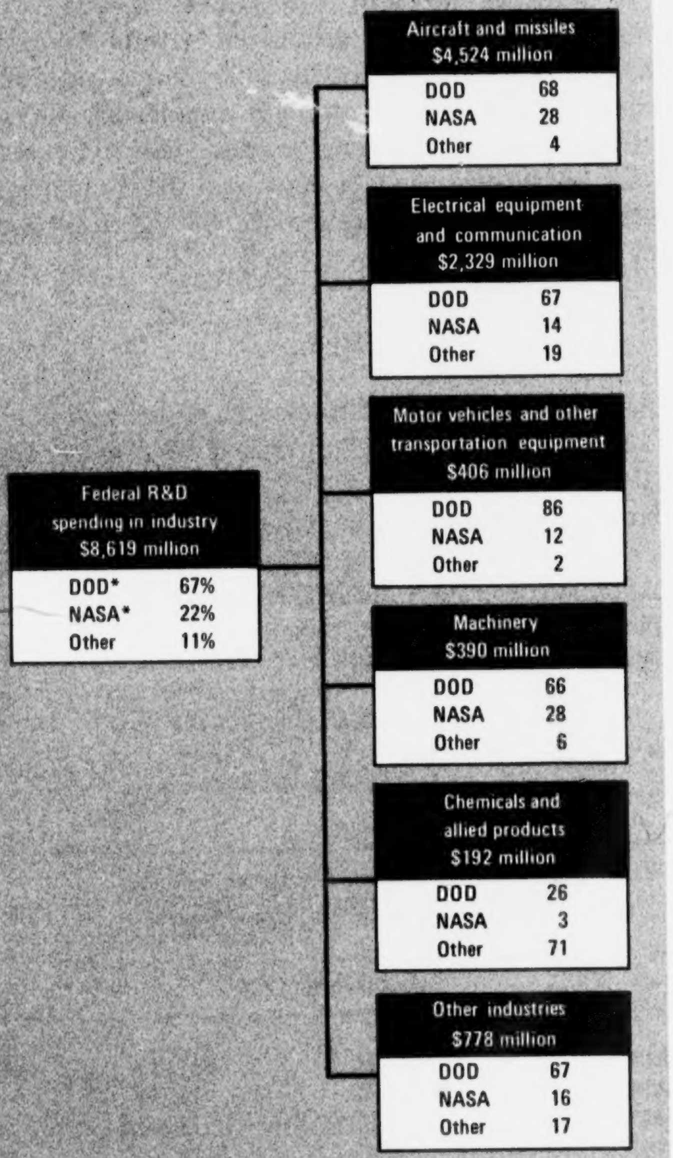
---

[1] National Science Foundation, *Federal Funds for Research, Development, and Other Scientific Activities, Fiscal Years 1969, 1970, and 1971*, vol. XIX (NSF 70-38) (Washington, D.C. 20402; Supt. of Documents, U.S. Government Printing Office, 1971.)

Industrial research and development for DOD and NASA

Two-thirds of the Federal R&D monies in industry were provided by the Department of Defense during 1969. The National Aeronautics and Space Administration (NASA) contracted an additional 22 percent while all other Federal agencies provided the remaining 11 percent. The only industry where the DOD and NASA share did not exceed 80 percent was the chemicals industry where 71 percent of the Federal R&D contract work was financed by other agencies, primarily the Atomic Energy Commission and the Department of Health, Education, and Welfare.

Distribution of Federal R&D spending in industry, by principal agency, 1969


Federal R&D spending in industry $8,619 million
DOD* 67%
NASA* 22%
Other 11%
Aircraft and missiles $4,524 million
DOD 68
NASA 28
Other 4
Electrical equipment and communication $2,329 million
DOD 67
NASA 14
Other 19
Motor vehicles and other transportation equipment $406 million
DOD 86
NASA 12
Other 2
Machinery $390 million
DOD 66
NASA 28
Other 6
Chemicals and allied products $192 million
DOD 26
NASA 3
Other 71
Other industries $778 million
DOD 67
NASA 16
Other 17

*DOD – Department of Defense; NASA – National Aeronautics and Space Administration.

Source: National Science Foundation

Company-financed R&D performance

In 1969 companies invested $9.9 billion of their own funds in R&D activities. This was 11 percent more than was spent on these activities in 1968 and compares with no increase in Federal R&D support between 1968 and 1969.

In addition to the $9.9 billion of company-sponsored R&D effort conducted within the companies' own laboratories in 1969, industrial firms provided $279 million to outside organizations. One-half of this money was contracted to other companies, while universities and colleges and other nonprofit institutions were the recipients of the remaining one-half.

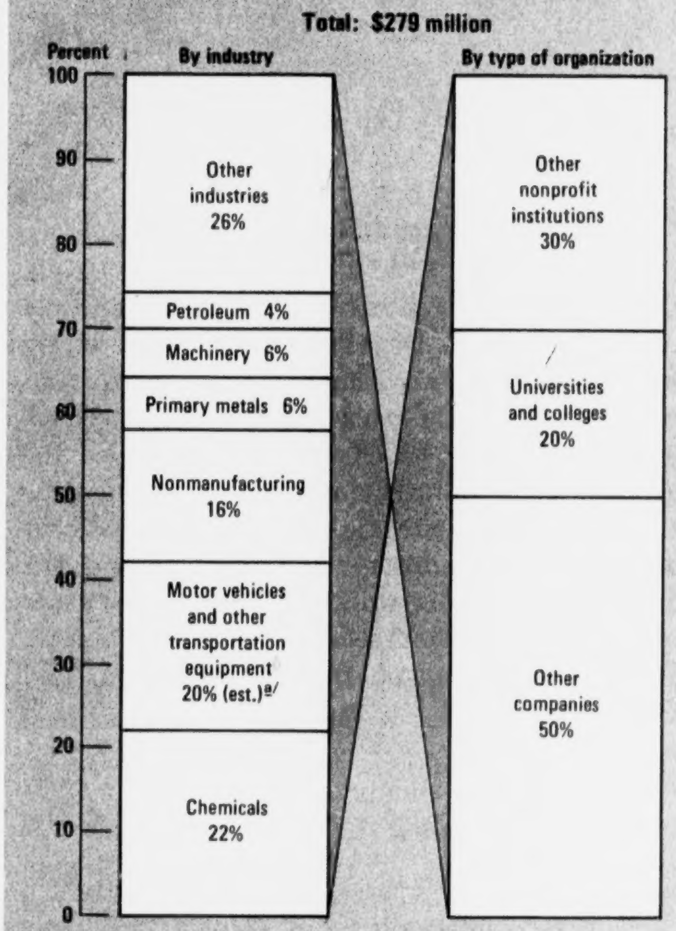
Company investment in research and development is one way for industry to improve its profit potential; for many firms, another way is investing in new plant and equipment. The following table shows that since 1960 industry has spent between one-third and one-fourth as much on R&D activities as on new plant and equipment. In recent years, however, this ratio has been increasing.

Year	Company-financed research and development in manufacturing companies	Business expenditures for new plant and equipment for manufacturing companies	R&D as a percent of new plant and equipment
	(Dollars in billions)		
1953	[a] $2.16	$11.86	18
1955	[a] 2.42	11.89	20
1960	4.37	15.09	29
1965	6.33	23.44	27
1966	7.09	28.20	25
1967	7.85	28.51	28
1968	8.70	28.37	31
1969	9.76	31.68	30

[a] Estimated.

Sources: National Science Foundation and Department of Commerce, Office of Business Economics.

Company-financed research and development contracted to outside organizations, by industry and type of organization, 1969



[a] Estimated by National Science Foundation.

Source: National Science Foundation

(For detailed data on this section see appendix tables B-1 through B-11, and B-17.)

Employment of R&D Scientists and Engineers

In January 1970, industrial firms employed the full-time-equivalent (FTE) of 380,600 R&D scientists and engineers, a decline of 6,500 from the January 1969 level. This decrease of nearly 2 percent over the year was primarily attributable to manpower cutbacks in the aircraft and missiles industry. Over the year, employment of scientists and engineers in this industry dropped from 97,600 to 90,000, with slightly more than one-half of the decline affecting professionals engaged in Federal contract work, primarily for the National Aeronautics and Space Administration. There are indications that this decline is continuing.

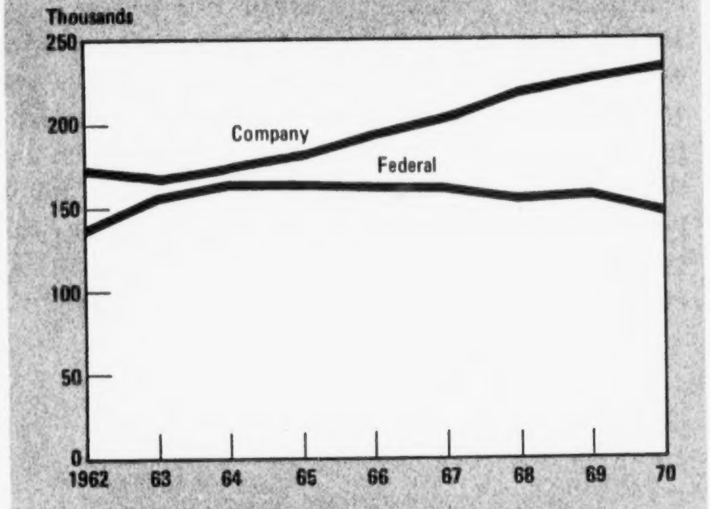
In addition, between January 1969 and January 1970, scientist and engineer employment on company-funded R&D activities in the aircraft and missiles industry fell by 3,500 persons, a decline of 13 percent. Despite this decline in personnel, aircraft firms increased their company R&D spending by 11 percent between 1968 and 1969, all of it in development work. This largely reflected the completion of the research phase of some commercial R&D projects, and the shifting of emphasis into the more expensive developmental work of producing prototypes.

The only other industries reporting significant decreases in scientist and engineer employment over the year were motor vehicles—down 1,000 to 23,700, and fabricated metal products—off 600 to 6,000 R&D professionals. Virtually all of the manpower decline was in companies employing 10,000 or more persons. Industries showing important increases between January 1969 and 1970 were machinery (up 1,300), drugs (up 700), and electrical equipment (up 700).

Sources of support

Beginning in 1964, the number of scientists and engineers engaged in Federal Government R&D efforts undertaken by industrial firms dropped by 18,000, from nearly one-half of the all-industry total, to less than 40 percent by the beginning of 1970. In contrast, the count of R&D professionals engaged in company-funded activities continued to rise all through the sixties.

Number of R&D scientists and engineers a/ by source of support, January 1962–70



a/ Full-time equivalent

Source: National Science Foundation

The industry employing the largest number of R&D scientists and engineers working on company programs in January 1970 was electrical equipment and communication, followed by the chemicals industry. The primary employer of R&D professionals engaged in contract work for the Government was the aircraft and missiles industry.

Employment gains: scientific vs. other industrial

A measure of the relative emphasis placed on science and technology within industrial firms is the ratio of R&D scientists and engineers to total employment. In 1969 there were 26 of these scientific professionals for every 1,000 employees in R&D-performing companies, down from 30 in 1964 and 1965. Placement of scientists and engineers into R&D activities has not kept pace with the overall employment growth of these firms. The ratio decline has been particularly steep in the aircraft industry, falling from 113 in 1965 to 78 in 1969.

(For detailed data on this section see appendix tables B-12 through B-16, B-18, and B-19.)

Distribution of R&D Funds, by Size of Company and R&D Program

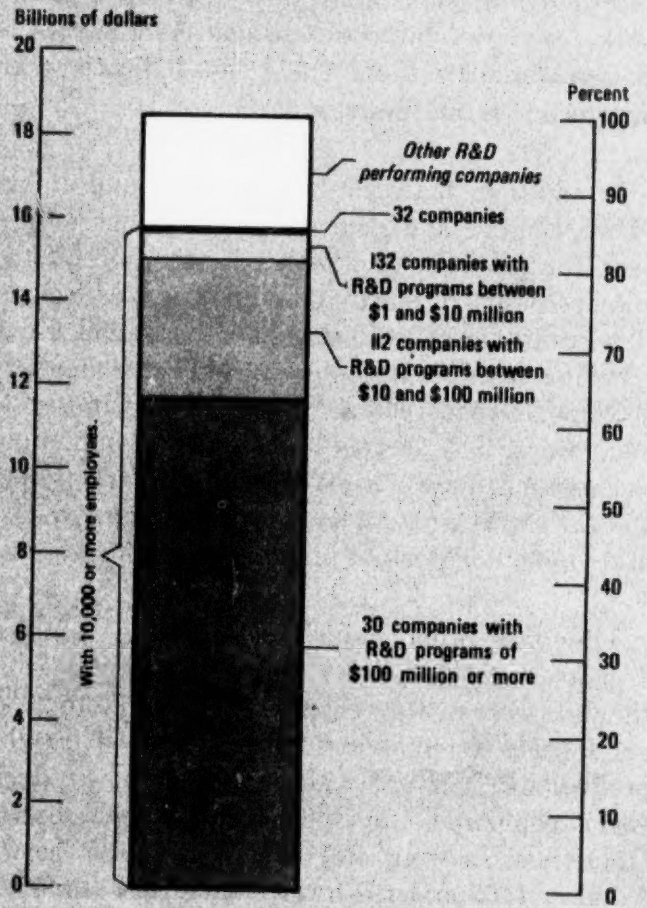
- Industrial R&D performance is heavily concentrated in a relatively small number of large R&D-performing companies. Only 3 percent of the estimated 11,000 R&D-performing companies had 10,000 or more employees in 1969. Yet these companies accounted for 85 percent of the research and development conducted in industry. The 209 R&D-performing companies (2 percent of total) with employment between 5,000 and 9,999 spent an additional 6 percent of the industrial R&D total.

- Fifty-six percent of the research and development in industry in 1969 was performed by twenty companies.

- Thirty companies had R&D programs of $100 million or more during 1969. The average size R&D program of these companies was nearly $400 million.

- Only 6 percent of the R&D-performing companies had R&D programs of $1 million or more in 1969. Forty-two percent of these companies had 10,000 or more employees and these firms conducted 85 percent of all industrial research and development during the year.

R&D concentration among companies with 10,000 or more employees, by size of R&D program,[a] 1969



[a] If these companies were ranked by volume of sales, the levels of R&D concentration would be lower.

Source: National Science Foundation

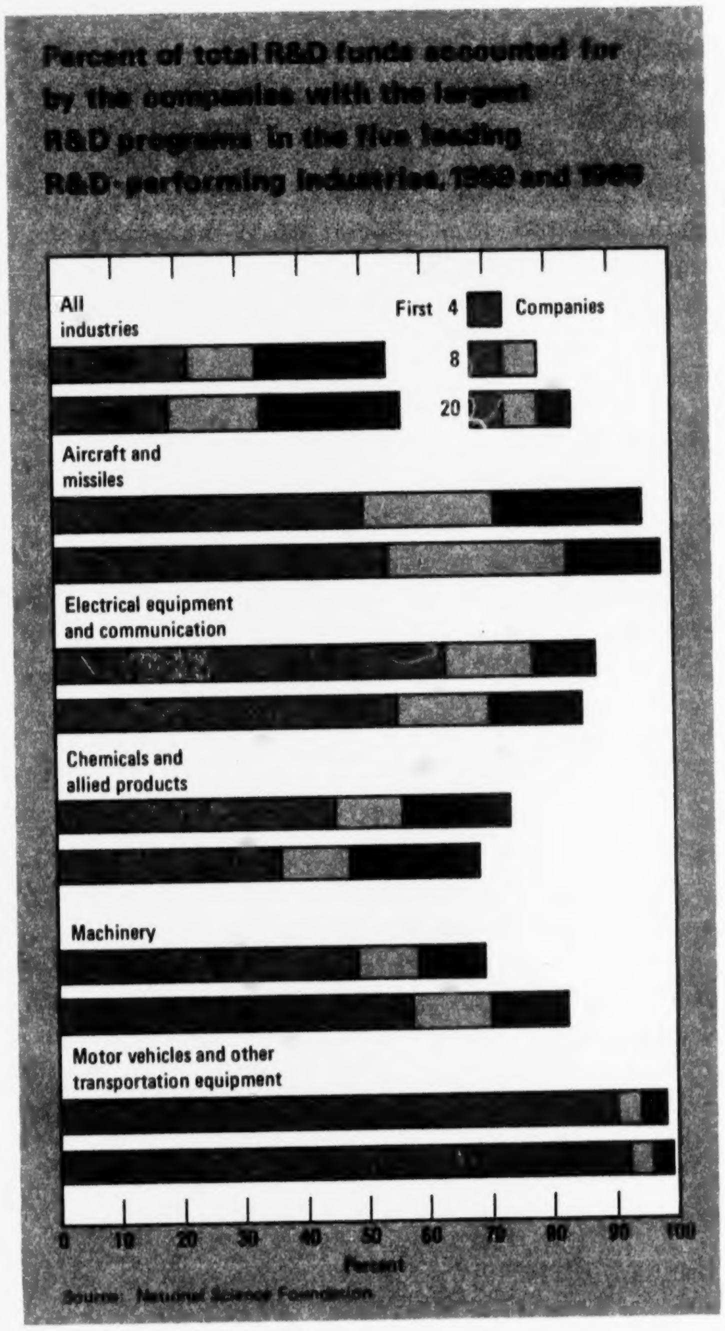
- The four largest R&D-performing companies performed 19 percent of the research and development in industry during 1969. This amounted to $3.5 billion. These same firms accounted for 7 percent of the sales of all R&D-performing companies and, on the average, spent over 10 percent of their sales on R&D activities, more than 2.5 times the all-industry average.

- These concentration ratios are based on ranking companies by size of R&D program. If companies were ranked by sales size, the levels of concentration would differ.

- The R&D concentration ratios for the four largest R&D-performing companies in each of the five leading industries ranged from 36 percent in chemicals to 92 percent in motor vehicles.

- In only two industries—chemicals and nonmanufacturing—did the 20 largest R&D-performing companies perform less than 70 percent of the industry's research and development. The ratios were 68 percent in the former industry and 60 percent in the latter.

- The four leading R&D-performing companies conducted 25 percent of all the Federal R&D contract work in industry in 1969. The top 20 companies performed 71 percent.


Percent of total R&D funds accounted for by the companies with the largest R&D programs in the five leading R&D-performing industries, 1963 and 1969

Source: National Science Foundation

(For detailed data on this section see appendix tables B-20 through B-25.)

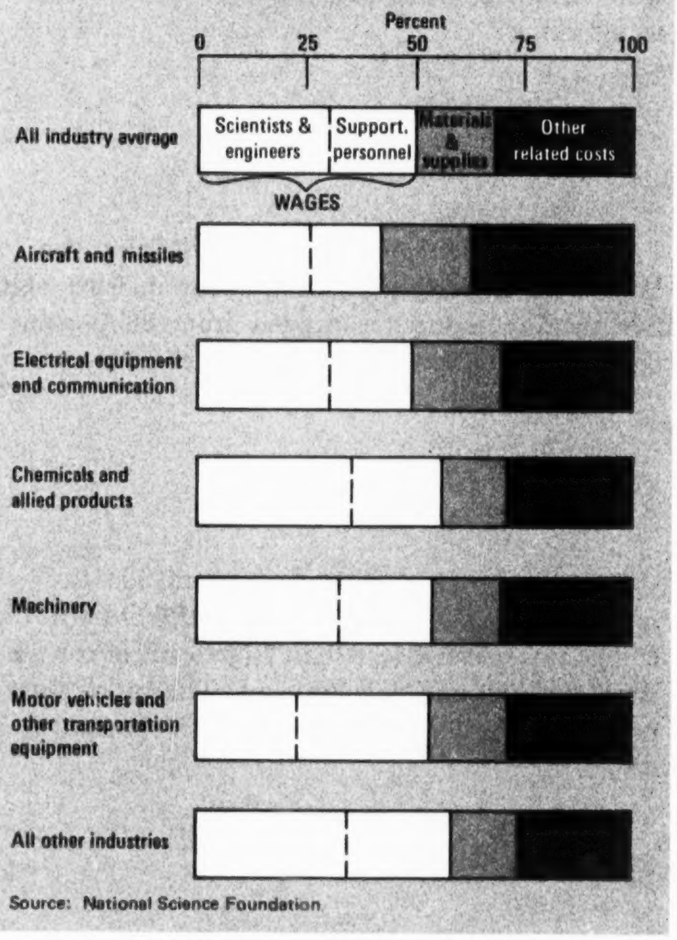
Distribution of R&D Funds, by Major Type of Cost

- Companies accounting for 76 percent of all-industry R&D spending in 1969 reported these allocations by major type of cost. These costs were broken down as follows: salaries and wages of R&D scientists and engineers, 30 percent; salaries and wages of supporting personnel, 20 percent; materials and supplies, 18 percent; and other R&D-related costs, 32 percent. This represented a somewhat greater allocation to salaries of R&D scientists and engineers and less allocation to materials and supplies than in 1962.

- In all major manufacturing industries—except aircraft and electrical equipment—salaries and wages accounted for more than one-half of all R&D costs in 1969.

- During 1969, other R&D-related costs made up the highest proportion of total R&D costs in the aircraft industry—39 percent. The lowest proportions were in the instruments and lumber industries—22 percent.

Distribution of R&D costs, by industry and type of cost, 1969



Source: National Science Foundation

Cost per R&D scientist or engineer, by industry and type of cost, 1969

Industry	Man years of R&D scientists and engineers	Total cost per R&D scientist or engineer	Salaries and wages per R&D scientist or engineer	Supporting personnel cost per R&D scientist or engineer	Materials and supplies cost per R&D scientist or engineer	Other costs per R&D scientist or engineer
All industries	383,200	$48,200	$14,300	$9,500	$8,800	$15,600
Aircraft and missiles	93,900	61,800	15,800	9,600	12,500	23,900
Electrical equipment and communication	100,800	42,600	12,600	7,900	8,700	13,400
Chemicals and allied products	42,000	41,700	15,000	8,800	6,000	11,900
Machinery	43,400	40,300	13,200	8,600	6,500	11,900
Motor vehicles and other transportation equipment	23,900	68,900	16,100	22,200	12,100	18,500
Professional and scientific equipment	13,400	49,600	17,900	12,200	8,400	11,100
Other industries	65,800	39,100	13,500	7,700	5,800	12,100

Note: Detail may not add to total because of rounding.

- The transportation industries—aircraft and motor vehicles—had the highest costs per R&D scientist or engineer in 1969.

- Scientists and engineers in the instruments industry received the highest average salary in 1969, nearly $18,000 per man. This was 25 percent above the all-industry average.

- The motor vehicles industry was the only industry in which total salaries of supporting personnel exceeded total salaries of R&D scientists and engineers during 1969. In this industry, supporting personnel costs per R&D scientist or engineer were more than double the all-industry average.

- Materials and supplies costs per R&D scientist or engineer were highest in the aircraft and motor vehicles industries during 1969. These were the only industries where average materials costs per R&D professional exceeded the all-industry average.

(For detailed data on this section see appendix tables B-26 and B-27.)

Basic Research, Applied Research, and Development

In 1969 industrial firms spent $646 million on basic research, $3.3 billion on applied research, and $14.5 billion on development. This amounted to 17 percent, 59 percent, and 86 percent of all the basic research, applied research, and development, respectively, performed in the Nation during that year.

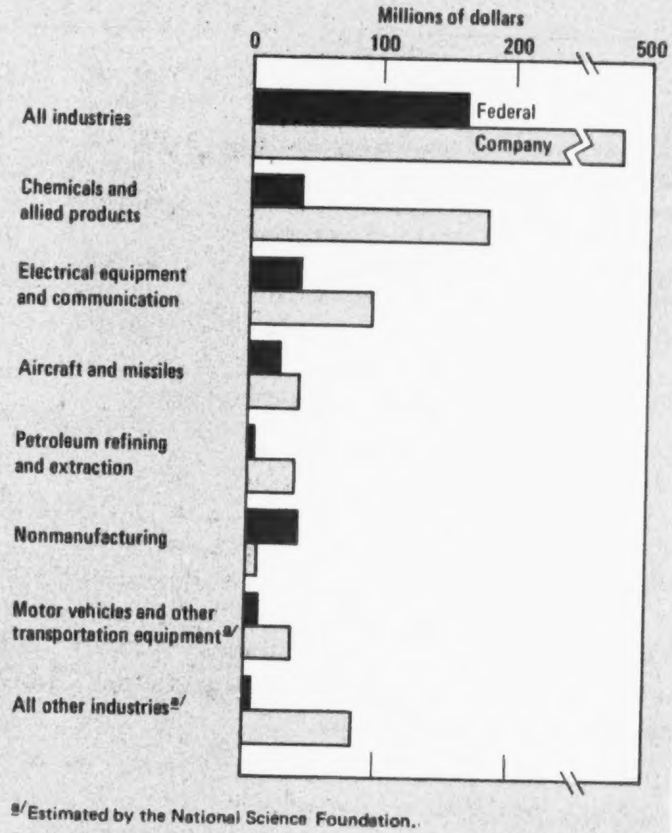
Basic research, by industry

Thirty-five percent of the industrial basic research effort was conducted by chemical companies in 1969. An additional 21 percent was performed by firms in the electrical equipment industry. The aircraft industry was the third leading performer of basic research during the year with 10 percent of the total.

Basic research, by source

In 1969 companies spent 5 percent of their own R&D funds on basic research programs. This amounted to $481 million during the year and represented about 75 percent of all basic research monies spent in industry. Industrial firms supported a higher percent of the basic research they perform with their own funds than either applied research or development. The chemicals industry was the leading performer of company-sponsored basic research in 1969, spending nearly two-fifths of the company total. In this industry, firms devoted 12 percent ($182 million) of their own R&D funds to basic research. Electrical equipment firms spent about 5 percent ($96 million) of their own R&D funds on basic research during the year.

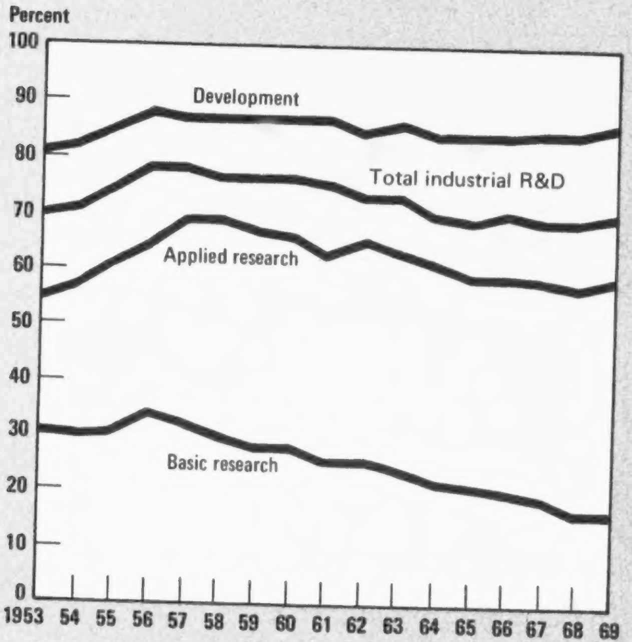
Industrial basic research, by industry and source, 1969



a/ Estimated by the National Science Foundation.

Source: National Science Foundation

Industrial R&D by character of work as a percent of total R&D, 1953-69



Source: National Science Foundation

Two percent of Federal R&D support to industry was devoted to basic research during 1969. About 75 percent of this amount went to companies in the chemicals industry ($41 million), electrical equipment industry ($41 million), and nonmanufacturing industries ($40 million). An additional 15 percent was contracted to aircraft firms.

Basic research, by field of science

Over one-half of the basic research dollars in industry in 1969 was spent on the physical sciences. About two-thirds of this amount was spent on chemistry research during the year. The chemicals industry was the major performer of basic research in chemistry, conducting an estimated one-half of all basic research in this field during 1969. The chemicals industry also spent $60 million on basic research in the life sciences. This was about three-fourths of all the life sciences basic research performed by industry in that year.

Basic research in engineering amounted to $176 million during 1969. Over two-thirds of this work was financed by companies in the electrical equipment, aircraft, and motor vehicles industries.

Applied research and development, by industry

Applied research and development accounted for the bulk of industrial research and development in 1969—$17.8 billion. Nearly $10 billion of this amount was spent by firms in the aircraft and electrical equipment industries. These industries, with their heavy involvement in Federal R&D contract work, financed about two-thirds of their applied research and development with Federal monies in 1969. All other industries combined financed only one-third of this effort with Federal funds.

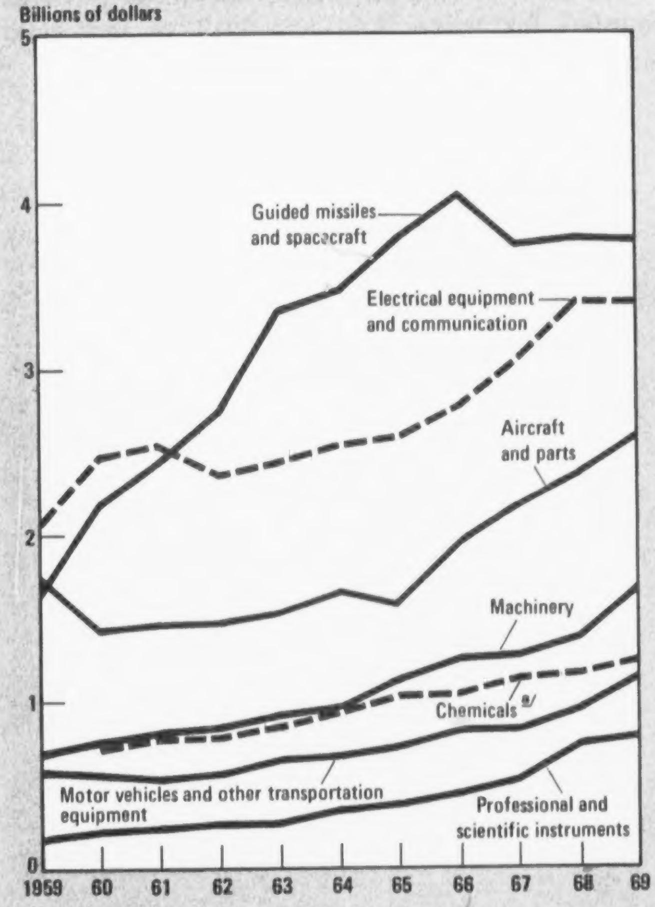
The electrical equipment industry, in addition to being the second leading performer of Federal applied research and development work in 1969 was also the leading performer of company-sponsored applied research and development, spending $1.9 billion. Other industries to spend more than $1 billion of their own funds on applied research and development projects in 1969 were chemicals, $1.4 billion; machinery, $1.3 billion; motor vehicles, an estimated $1.2 billion; and aircraft and missiles, $1.2 billion. Together, these five industries accounted for about three-fourths of all company-sponsored applied research and development spending during the year.

Applied research and development, by product field

Applied research and development spending can also be looked at by the product areas being emphasized by industrial firms. More applied research and development money was spent on guided missiles and spacecraft—$3.8 billion—than on any other product field during 1969. Nearly 80 percent of this work was conducted by companies in the aircraft and missiles industry with an additional 16 percent being performed by electrical equipment firms.

Two other product fields received over $2 billion of applied research and development support during 1969—electrical equipment and communication, $3.4 billion; and aircraft and parts, $2.5 billion. Four-fifths of this work was performed by aircraft and electrical equipment companies.

Applied research and development, by major product field, 1959—69



a/ Data for 1959 not available.
Source: National Science Foundation

Since companies seldom limit their applied research and development dollars to a single product field, it is useful to know what percent of these dollars are directed towards the companies' major products. The following table indicates the "specialization ratios" for selected industries. This ratio was obtained by calculating the percent of total applied research and development directed to each industry's primary products.

Industry	*1969 specialization ratio*[a]
Aircraft and missiles	87.1
Chemicals and allied products	79.3
Primary metals	62.5
Machinery	62.2
Motor vehicles and other transportation equipment	[b] 57.0
Electrical equipment and communication	50.0
Petroleum refining and extraction	42.6
Professional and scientific instruments	[b] 42.0
Fabricated metal products	40.0

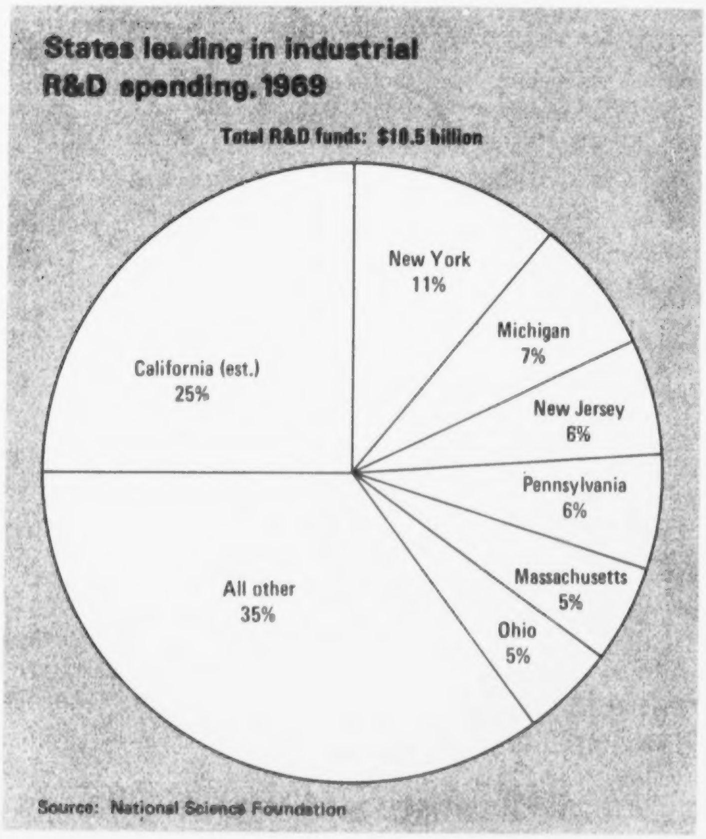
[a] These specialization ratios are not directly comparable with those of previous years because of the changes in the "other product fields" category. These ratios are intended to show the high degree of R&D diversification within industry.

[b] Estimated by the National Science Foundation.

(For detailed data on this section see appendix tables B–28 through B–42.)

Geographic Distribution of R&D Funds

- In 1969, two States, California and New York, accounted for more than one-third of industrial research and development.



States leading in industrial R&D spending, 1969

Total R&D funds: $10.5 billion

Source: National Science Foundation

- Ten States had industrial R&D expenditures above $500 million in 1969. The seven leading States spent 65 percent of the all-industry total that year.

- Over the past 5 years, seven out of the ten States leading in R&D spending experienced increases greater than the 37 percent national average. Massachusetts, the leading gainer, rose 92 percent during this period.

Increases in R&D spending in leading R&D-performing States, 1964-69

States with 1969 R&D expenditures in excess of $500 million	Percent increase, 1964–69
Massachusetts	92
Ohio	60
Illinois	57
Pennsylvania	55
New York	48
Michigan	44
Connecticut	41
U.S. average	37
New Jersey	24
California[a]	21
Texas	7

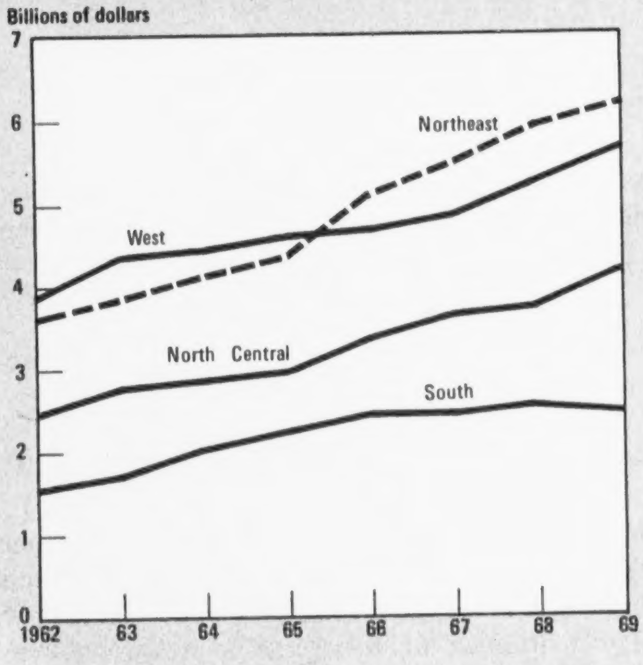
[a] Estimated by National Science Foundation.

- Between 1968 and 1969, the only region of the country to show a reduction in R&D expenditures was the South, down 2 percent. This largely reflected cutbacks in the South Central States of Texas, Alabama, and Louisiana. For the latter two States these declines are part of a long-term trend. Industrial R&D funds in Louisiana fell from $282 million to $104 million between 1964 and 1969. In Alabama, the drop over the 1966–69 period was from $238 million to $125 million.

- In addition to the two South Central divisions, only one other division had fewer industrial R&D dollars in 1969 compared to a year earlier—New England. The slight decrease of $18 million was almost entirely attributable to decreased R&D spending by industrial firms located in Connecticut.

- Three States—California, New York, and Massachusetts—accounted for over one-half of the Federal R&D effort performed by industry. About one-third of all company-funded research and development was conducted in Michigan, New York, and New Jersey.

Geographic distribution of industrial R&D funds, 1962–69



Source: National Science Foundation

- There is substantial variation in the geographic pattern of Federal and company R&D spending. During 1969, the Pacific division accounted for over two-fifths of all industry-performed Federal R&D contract work. Yet, firms in this division spent only 14 percent of total company R&D funds. Conversely, R&D-performing companies in the East North Central division spent 31 percent of all company funds during 1969, but only 6 percent of the Federal total.

(For detailed data on this section see appendix tables B–43 and B–44.)

R&D Funds Related to Employment and Net Sales

- R&D funds, when related to employment and net sales data, show the relationship between R&D spending and these two measurements of size.

- In 1969 R&D expenditures per employee amounted to $1,250, an increase of 3 percent over the 1968 ratio of $1,210.

- Company financing of R&D performance per employee increased 10 percent between 1968 and 1969 to a level of $670. Federal R&D funds per employee dropped by 3 percent over the year to $580.

- Four industries in 1969 had above average ratios of R&D expenditures to total employment. These were aircraft, $4,800; electrical equipment, $1,890; instruments, $1,590; and chemicals, $1,490. Two additional industries—motor vehicles and machinery had R&D costs per employee of over $1,000. The ratios in these industries were $1,240 and $1,110, respectively.

- These same six industries were also the ones to lead in relationship of company R&D funds per employee during 1969.

- A company's R&D/sales ratio is a useful indicator of the allocation of receipts to research and development. It is, however, an after-the-fact measure and is seldom the sole determinant of a company's R&D budget.

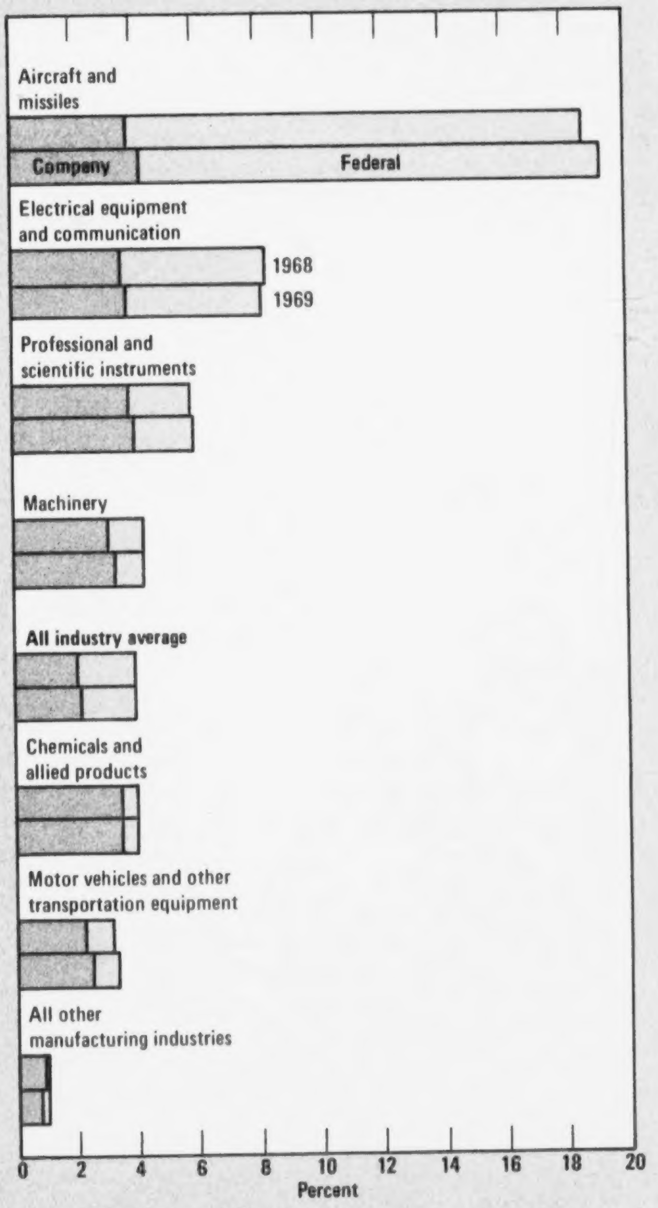
- In 1969 R&D-performing manufacturing companies spent an average of 4.0 percent of their net sales on R&D activities. This was the same ratio as in 1968 but down from a high of 4.6 percent in 1964. These same firms allocated 2.2 percent of their net sales to company-sponsored R&D programs, up from 2.1 percent in 1968.

- The aircraft industry had the highest R&D/sales ratio in 1969—19.3 percent. This is up from 18.7 percent in 1968 but down from the 1964 high of 28.9 percent. All of this decrease is due to the leveling in Federal R&D funds to this industry.

- Only six industries registered gains in their company R&D funds/net sales ratios between 1964 and 1969. They were rubber, 1.0 percent to 1.7 percent; stone, clay, and glass, 1.6 percent to 1.9 percent; primary metals, 0.7 percent to 0.8 percent; machinery, 3.2 percent to 3.4 percent; electrical equipment, 3.6 percent to 3.7 percent; and aircraft, 2.5 percent to 4.3 percent.

- The cost per R&D scientist or engineer amounted to $48,200 in 1969, an increase of 5 percent over the 1968 level. These costs vary widely by industry. The industries with the highest cost per scientist or engineer ratios in 1969 were motor vehicles, $68,900, and aircraft, $61,800.

R&D funds as a percent of net sales, by industry and source, 1968 and 1969



Source: National Science Foundation

- In 1969, the 300 largest R&D-performing manufacturing companies spent nearly 2.5 times as much per R&D professional than all other R&D-performing manufacturing companies.

(For detailed data on this section see appendix tables B–45 through B–56.)

APPENDIXES

A. Technical Notes
B. Statistical Tables
C. Covering Letters, Questionnaire, and Instructions

17/18

Appendix A

TECHNICAL NOTES

Scope of Study

The National Science Foundation sponsored its first survey of industrial research and development in 1953. Since then, the scope of the survey has gradually been expanded and refined in response to an increasing need for more detailed information on the Nation's R&D effort.

The 1969 industry survey is the 13th in the annual series sponsored by the Foundation and conducted by the Bureau of the Census, U.S. Department of Commerce. The Foundation also sponsored two industry surveys covering the 1953–56 period, which were conducted by the Bureau of Labor Statistics (BLS), U.S. Department of Labor.[1] Data obtained in the BLS surveys are not directly comparable with the Census figures for 1957–69 because of methodological and other differences in the surveys conducted by the two agencies. In addition, the Census surveys, beginning in 1957, have collected data on the R&D activities of Federally Funded Research and Development Centers (FFRDC's) operated by business firms, whereas the earlier BLS surveys did not. To account for the R&D performance of these research centers in 1956, Census adjusted data for that year (collected in the 1957 survey) to provide comparable trend data for 1956 and earlier years.

The statistics presented in this report are subject to response and concept errors caused by differences between survey and industry concepts and definitions of R&D activities and by variations in company accounting procedures. Consequently, the accuracy of the data provided by respondents is subject to some variation.

Since the first industry survey in 1953, the quality of the data has improved substantially. This is due mainly to more accurate and sophisticated accounting procedures adopted by respondents. In addition, the Foundation and the Bureau of the Census have continued their efforts to reduce response and concept errors arising from difficulties in interpreting or applying survey definitions.

Survey Definitions[2]

Research and development.—Basic and applied research in the sciences and engineering and the design and development of prototypes and processes. This definition excludes quality control, routine product testing, market research, sales promotion, sales service, research in the social sciences or psychology, and other nontechnological activities or technical services.

Basic research.—Original investigations for the advancement of scientific knowledge not having specific commercial objectives, although such investigations may be in fields of present or potential interest to the reporting company.

Applied research.—Investigations directed to the discovery of new scientific knowledge having specific commercial objectives with respect to products or processes. This definition differs from that of basic research chiefly in terms of the objectives of the reporting company.

Development.—Technical activities of a nonroutine nature concerned with translating research findings or other scientific knowledge into products or processes. Does not include routine technical services to customers or other activities excluded from the above definition of research and development.

Funds for R&D performance.—Operating expenses incurred by a company in the conduct of research and development in its own laboratories or other company-owned or -operated facilities. Includes wages and salaries, materials, and supplies consumed, property and other taxes, maintenance and repairs, depreciation, and an appropriate share of overhead, but excludes capital expenditures. Funds for R&D performance are expressed in current dollars rather than in constant dollars.

---

[1] National Science Foundation, *Science and Engineering in American Industry, Final Report on a 1953–54 Survey* (NSF 56–16) and *Science and Engineering in American Industry, 1956* (NSF 59–50) (Washington, D.C. 20402; Supt. of Documents, U.S. Government Printing Office.)

[2] For more detailed information on definitions, as well as the instructions for individual items covered in the survey questionnaire, see appendix C.

Federally financed R&D performance.—Receipts for work done by the company on R&D contracts or subcontracts and R&D portions of procurement contracts and subcontracts.

Company-financed R&D performance.—Cost of the company-sponsored research and development performed within the company. Does not include company-financed research and development contracted to outside organizations, such as research institutions, universities and colleges, or other nonprofit organizations.

R&D scientists and engineers.—Those engaged full time in research and development and the full-time equivalent of those working part time. Scientists and engineers are defined as persons engaged in scientific or engineering work at a level which requires a knowledge of physical, life, engineering, or mathematical sciences equivalent at least to that acquired through completion of a 4-year college course with a major in one of those fields.

Total employment.—Total number of persons employed by the company in all activities during the pay period which includes the 12th of March. These data are not completely comparable with employment of R&D scientists and engineers data which are collected (1) as of January and (2) on a man-year basis.

Net sales and receipts.—Recorded dollar values for goods sold or services rendered by a company to customers outside the company, including the Federal Government, less such items as returns, allowances, freight charges, and excise taxes. Excludes domestic intracompany transfers as well as sales by foreign subsidiaries, but includes transfers to foreign subsidiaries. Net sales and receipts figures are expressed in current dollars rather than constant dollars.

R&D concentration.—Tables showing R&D concentration ranked by size of R&D program, not by volume of sales.

Geographic area covered.—Includes only those operations located in the 50 States and the District of Columbia.

Explanation of Tabular Data

Industry classification.—Industries and industry groups shown separately in statistical tables are classified according to their *Standard Industrial Classification Manual*[3] codes as follows:

Food and kindred products (20)
Textiles and apparel (22, 23)
Lumber, wood products, and furniture (24, 25)
Paper and allied products (26)
Chemicals and allied products (28)
  Industrial chemicals (281–82)
  Drugs and medicines (283)
  Other chemicals (284–89)
Petroleum refining and extraction (29, 13)[4]
Rubber products (30)
Stone, clay, and glass products (32)
Primary metals (33)
  Ferrous metals and products (331–32, 3391, 3399)
  Nonferrous metals and products (333–36, 3392)
Fabricated metal products (34)
Machinery (35)
Electrical equipment and communication (36, 48)[4]
  Radio and TV receiving equipment (365)
  Communication equipment and electronic components (366–67, 48)
  Other electrical equipment (361–64 and 369)
Motor vehicles and other transportation equipment (371, 373–75, 379)
Aircraft and missiles (372, 19)[5]
Professional and scientific instruments (38)
  Scientific and mechanical measuring instruments (381–82)
  Optical, surgical, photographic, and other instruments (383–87)
Other manufacturing industries—Tobacco manufactures (21), printing and publishing (27), leather products (31), and miscellaneous manufacturing industries (39)
Nonmanufacturing industries—Agriculture, forestry, and fisheries (07–09); mining (10–12, 14); contract construction (15–17); transportation and other public utilities (41–47, 49); wholesale and retail trade (50–59); finance, insurance, and real estate (60–67); and selected service industries (739, 807, 891).

Company size-class.—The size of a company as determined by the total number of its employees. The four company size-classes used in this report are less than 1,000 employees; 1,000–4,999 employees; 5,000 – 9,999 employees; and 10,000 or more employees.

Classification of reporting units.—The company or corporate family which includes all establishments under common ownership or control. Similarly, each company was classified in a single size-category on the basis of its total employment.

---

[3] Executive Office of the President, Bureau of the Budget, *Standard Industrial Classification Manual, 1967*. (Washington, D.C. 20402; Supt. of Documents, U.S. Government Printing Office). Industry group code numbers are shown in parentheses.

[4] For the purposes of this study, crude petroleum and extraction (13) is grouped with petroleum refining (29), and communication (48) is grouped with electrical equipment (36), in the manufacturing group of industries.

[5] Companies primarily engaged in the manufacture of ordnance and accessories, including complete guided missiles, are grouped with companies primarily engaged in the manufacture of aircraft and parts because of close similarity of R&D activities carried out by major companies in the two industries.

Cost per R&D scientist or engineer.—The number of R&D scientists and engineers used to estimate the cost per R&D scientist or engineer for 1967–69 is the number of man-years; between 1957 and 1966, the arithmetic mean of the numbers of R&D scientists and engineers reported in each industry for January in 2 consecutive years was used.

Nonavailability of certain statistics.—Estimates withheld for not meeting publication standards for reasons such as excessively high associated sampling error of estimate; high rate of imputation because of failure of companies to report; possible disclosure of data of an individual company; or cases where data were inconsistent for inclusion in a time series. In tables, the term "not separately available but included in total" indicates statistics could not be published for any of these reasons.

Method of computation.—Detailed statistics in the tables may not add to totals or subtotals because of rounding. Also, percentages were calculated on the basis of thousands of dollars and may differ from those based on the rounded figures shown.

Methodology of Survey[6]

The sample used for the 1969 Survey of Industrial Research and Development represented all manufacturing industries, and those nonmanufacturing industries shown in earlier, more detailed samples to conduct or finance research and development. As in previous years, the survey was a mail canvass. However, for the 1969 survey, approximately 1,100 companies which reported less than $200,000 in R&D expenditures in 1968 were not required to report. Data for these companies were estimated at their 1968 levels. These companies accounted for less than 2 percent of total R&D expenditures.

In manufacturing, the sampling unit was the company, defined as all establishments under common ownership or control. All manufacturing companies with greater than 1,000 employees in 1963 were included in the sample with certainty.[7] The source for sampling multi-unit manufacturing companies was the 1963 Census Enterprise Statistics multi-unit file. Single-unit manufacturing companies were sampled from the 1963 Census universe file. The nonmanufacturing sample was drawn from the 1966 records of the Social Security Administration.

Approximately 8,000 manufacturing and nonmanufacturing companies are included in the sample. More than 1,800 of these are certainty companies (those with greater than 1,000 employees and others in selected industry-size strata) and they accounted for almost 95 percent of the total R&D performance funds. Appendix tables A–1 and A–2 show the probabilities of selection applied for each industry-size stratum.

Each year the annual Department of Defense and National Aeronautics and Space Administration lists of R&D contractors are reviewed to insure that the large contractors are included in the sample. For the 1969 survey, the 80 largest companies from the Department of Defense list and the 50 largest National Aeronautics and Space Administration contractors were included in the sample with certainty regardless of their industry class and employment size. The 80 largest companies from the Department of Defense list accounted for 94 percent of the total funds of all companies listed. The 50 largest companies from the National Aeronautics and Space Administration list accounted for 96 percent of the total funds of all companies listed.

The particular sample selected is one of a large number of samples of the same type and size that, by chance, might have been selected. Estimates from each of the different samples would differ somewhat from each other, and from the results of a complete canvass conducted under essentially the same conditions as the survey. This variation among the possible estimates is defined by the sampling error, measured in standard error units. The complete canvass total would be included in the range—

(1) From one standard error below to one standard error above the derived estimate for about two-thirds of all possible samples.

(2) From two standard errors below to two standard errors above the derived estimate for about 95 percent of all possible samples.

(3) From three standard errors below to three standard errors above the derived estimate, almost always.

These values may be interpreted as defining approximate probabilities that the estimate shown would differ from a complete canvass total by as much as one, two, or three standard errors, respectively.

For example, if an estimate is shown as 400, with an associated relative standard error of 2 percent, the chances are roughly two out of three that the complete canvass total would lie between 392 and 408; the chances are roughly 19 out of 20 that the complete canvass total would lie between 384 and 416; and it is almost certain that the complete canvass total would lie between 376 and 424.

---

[6] This section was prepared by the U.S. Bureau of the Census, the collecting and compiling agent for the National Science Foundation in this survey.

[7] This indicates that a sampling ratio of 1:1 (or 1.000) was employed in the selection of companies in this particular size class.

As stated, the standard error refers only to sampling variations. In addition to the sampling errors as measured by the standard error, the estimates are subject to errors in response, coding, processing, and imputation for nonresponse. These nonsampling errors would also occur if a complete canvass were to be conducted under the same conditions as the survey.

The 1969 standard errors of estimates for each industry, for all companies and for those with less than 1,000 employees, are shown in appendix table A–3.

The forms for the survey were mailed in April 1970, and nonrespondents were followed up by mail. The basic form used was the Form RD–1, but since total R&D performance funds and total Federal funds expended by industry for research and development are included in the Census Bureau's statistical program, the very few large companies that did not reply were mailed the census mandatory Form MA–121. Less than 1 percent of total R&D funds were obtained in this way and included in this report.

Appendix table A–4 shows the percent of total research and development funds for which a distribution by basic research, applied research, and development was estimated by the Bureau of the Census in the absence of respondent distributed data for 1968. This information is not available for 1969, but since these figures have changed little from year to year in past surveys, it is believed that the 1968 data will provide reasonable estimates for 1969.

Comparability of Data Over a Period of Several Years[6]

In the surveys of industrial research and development, there has been substantial comparability over any two-year period. This is because the respondent has had before him, on the same report form used in filing current data, the figures for the previous year entered on the form by the Census Bureau before mailing; the respondent has been asked to adjust the data for the previous year as necessary to make it comparable to those of the current year. Such adjustments have been made to reflect, for example, changes in reporting concepts or changes in company structure such as mergers or acquisitions. To further insure comparability, the industry and size classification have been adjusted so that they are the same for a company for the two adjacent years.

Some measure of the degree of change reflecting these adjustments in contrast to an actual change in research and development activity, can be gained by comparing figures for the same year reported in two succeeding forms, e.g., 1968 R&D statistics in the final report of the 1968 survey and the revised 1968 R&D statistics in the final report of the 1969 survey. The totals for broad classification are likely to be very close in the two reports, but in the finer detail larger differences are noticeable. The results underscore the point that the measures are approximate and indicative rather than precise.

When tables covering more than two years were prepared for this report, it was not considered feasible to carry most revisions back more than one year.

Industry Codes in These Historical Tables[6]

The industry codes appearing in the tables are based on the 1967 Standard Industrial Classification (SIC) Manual. The SIC classifications for individual companies for 1958–1962 were based upon data reported in the 1958 Economic Censuses; for 1963 to date, the SIC codes for each company were determined by data reported in the 1963 Economic Censuses. Between 1958 and 1963, the SIC code for a company generally remained fixed and reflected that company's principal activity in 1958. However, under certain circumstances— such as the merger of two or more companies; the acquisition of one company by another; or the formation of "conglomerates"—the 1958 SIC code for a company could change.

Most industry groups were characterized by relatively minor changes in the SIC codes for companies classified in those groups, and the tabulated data for such groups remained substantially comparable between 1958 and 1963. However, some industry groups were characterized by significant changes in the SIC codes for companies originally classified in those groups in 1958. The effect of these changes became most noticeable toward the end of the 5-year intercensal period, with the result that revisions to industry totals resulting from these code changes tended to reflect disproportionately large fluctuations between the data for 1963 and the year immediately preceding. To remedy these apparent discrepancies, the data for affected industries were adjusted as follows: For companies changing industry codes between 1958 and 1963, the industry data for each of the five years affected (1958 through 1962) were estimated to have changed at a constant rate (20 percent per year). Accordingly, the data for the industry in which such a company had been classified in 1958 were deflated by 20 percent per year for each of the affected years. Similarly, the data for the industry in which such a company was classified in 1963 were inflated by 20 percent per year for each of the intervening years. For the period 1963–1969, no changes have been made in company industry codes. The codes are those assigned as part of the 1963 Economic Census.

The following measures were adjusted in this manner: Number of scientists and engineers; funds for research and development—total, Federal, and company; net sales; total employment; and basic research expenditures. These historical data appear, for example, in appendix tables B–2, B–6, B–8, B–12, B–19, B–31, B–45, B–52, and B–53 of the 1969 NSF publication on research and development in industry. No adjustments were made in the data for other measures.

TABLE A–1.—*Sampling ratios used in the selection of manufacturing companies included in the survey of industrial research and development, by industry and size of company, 1969*

Industry	Companies with total employment of—			
	Less than 100	100 to 499	500 to 999	1,000 or more
Food and kindred products	0.004	0.054	0.285	1.000
Industrial chemicals	.026	1.000	1.000	1.000
Drugs and medicines	.010	.818	1.000	1.000
Other chemicals	.042	.255	1.000	1.000
Petroleum refining and extraction	.018	.547	1.000	1.000
Rubber products	.069	.351	.577	1.000
Ferrous metals and products	.005	.162	1.000	1.000
Nonferrous metals and products	.005	.500	1.000	1.000
Fabricated metal products	.002	.166	.667	1.000
Machinery	.017	.745	.745	1.000
Communication equipment and electronic components	.108	.525	1.000	1.000
Other electrical equipment	.040	.361	.368	1.000
Motor vehicles and other transportation equipment	.014	.038	.405	1.000
Aircraft and missiles	.049	.652	1.000	1.000
Scientific and mechanical measuring instruments	.127	.768	1.000	1.000
Optical, surgical, photographic, and other instruments	.028	.481	.611	1.000
Other manufacturing industries	.002	.059	.274	1.000

TABLE A-2.—*Sampling ratios used in the selection of nonmanufacturing companies in the survey of industrial research and development, by industry and size of company, 1969*

Industry	Industry code [b]	Companies with total employment of —[a]			
		50 to 99	100 to 499	500 to 999	1,000 or more
Agriculture, forestry, and fisheries	07–09	0.010	0.020	0.200	1.000
Mining, except petroleum extraction	10–12, 14	.050	.050	.100	1.000
Contract construction	15–17	.050	.100	.500	1.000
Transportation, except railroads [c]	41–47	.020	.020	.100	1.000
Public utilities and sanitary services	49	.100	.500	1.000	1.000
Wholesale trade	50–52	.010	.020	.200	1.000
Retail trade	53–59	.010	.020	.200	1.000
Finance, insurance, and real estate	60–67	.010	.020	.200	1.000
Miscellaneous business services	739	.200	.200	1.000	1.000
Medical and dental laboratories	807	1.000	1.000	1.000	1.000
Engineering and architectural services	891	.500	1.000	1.000	1.000
Other nonmanufacturing industries	---- ----------	.010	.020	.200	1.000

---

[a] Excludes nonmanufacturing companies with less than 50 employees.

[b] Executive Office of the President, Bureau of the Budget, *Standard Industrial Classification Manual, 1967*. (Washington, D.C. 20402: Supt. of Documents. U.S. Government Printing Office).

[c] Companies primarily engaged in rail transportation were not included in the sample because, according to earlier surveys, such companies account annually for a relatively small amount of research and development in terms of the national total (less than 0.25 percent).

Note: For the 1969 survey, the approximately 1,100 companies in the original sample with 1968 R&D programs of less than 200,000 were not mailed survey forms. Data for these companies were estimated at their 1968 levels in producing the 1969 estimates.

TABLE A-3.—*Standard error of estimates (percent) of funds for R&D performance for all company-size groups and for companies with less than 1,000 employees, by industry, 1968*[a]

Industry	Total	Companies with less than 1,000 employees
Total	([b])	7
Food and kindred products	1	28
Textiles and apparel	4	30
Lumber, wood products, and furniture	20	44
Paper and allied products	3	([c])
Chemicals and allied products		
Industrial chemicals	([b])	23
Drugs and medicines	2	38
Other chemicals	5	28
Petroleum refining and extraction	([b])	24
Rubber products	3	39
Stone, clay, and glass products	4	([c])
Primary metals		
Ferrous metals and products	([b])	25
Nonferrous metals and products	1	22
Fabricated metal products	4	21
Machinery	([b])	9
Electrical equipment and communication		
Radio and TV receiving equipment	2	([c])
Communication equipment and electronic components	([b])	13
Other electrical equipment	1	38
Motor vehicles and other transportation equipment	([b])	([c])
Aircraft and missiles	([b])	13
Professional and scientific instruments		
Scientific and mechanical measuring instruments	5	18
Optical, surgical, photographic, and other instruments	([b])	21
Other manufacturing industries	5	47
Nonmanufacturing industries	7	16

---

[a] A description of the standard error of estimate is given in appendix A under "Methodology of Survey." The percentage (or relative) standard errors in this table may be converted to standard errors of estimate by multiplying the percentage shown by the associated estimate. For example, the relative standard error of estimate for funds for R&D performance for all company size groups in the food and kindred products industry is shown as 1 percent. The standard error of estimate, then, is .01 times 185 equals 1.85.

[b] Less than 0.5 percent.

[c] More than 50 percent.

TABLE A-4.—*Percent of total R&D funds for which a distribution by basic research, applied research, and development was estimated in the absence of respondent distributed data, 1968*[a]

Industry	SIC code	Percent
Total		13
Food and kindred products	20	13
Textiles and apparel	22, 23	37
Lumber, wood products, and furniture	24, 25	22
Paper and allied products	26	5
Chemicals and allied products	28	23
Industrial chemicals	281–82	30
Drugs and medicines	283	16
Other chemicals	284–89	6
Petroleum refining and extraction	29, 13	5
Rubber products	30	16
Stone, clay, and glass products	32	34
Primary metals	33	28
Ferrous metals and products	331–32, 3391, 3399	50
Nonferrous metals and products	333–36, 3392	2
Fabricated metal products	34	7
Machinery	35	6
Electrical equipment and communication	36, 48	10
Radio and TV receiving equipment	365	31
Communication equipment and electronic components	366–67, 48	16
Other electrical equipment	361–64, 369	1
Motor vehicles and other transportation equipment	371, 373–75, 379	47
Aircraft and missiles	372, 19	--------
Professional and scientific instruments	38	46
Scientific and mechanical measuring instruments	381–82	11
Optical, surgical, photographic, and other instruments	383–87	(b)
Other manufacturing industries	07–12, 14–17	4
Nonmanufacturing industries	41–47, 49–67, 739, 807, 891	9

---

[a] This information is not available for 1969, but since these figures have changed little from year to year in past surveys, it is believed that the 1968 data will provide reasonable estimates for 1969.

[b] More than 50 percent.

Appendix B

STATISTICAL TABLES

Page

Total Funds for R&D Performance

B-1. Trends in funds for industrial R&D performance, by source, 1953-69 29
B-2. Funds for R&D performance, by industry and size of company, 1956-69 30
B-3. Funds for R&D performance, by industry and selected company size groups, 1969 31
B-4. Funds for R&D performance, by industry and selected company size groups, 1968 32
B-5. Funds for R&D performance, by industry, size of company, and size of R&D program, 1969 33

Federal Funds for R&D Performance

B-6. Federal funds for R&D performance, by industry and size of company, 1957-69 34
B-7. Federal funds for R&D performance, by industry and selected company size groups, 1968 and 1969 35

Company Funds for R&D Performance

B-8. Company funds for R&D performance, by industry and size of company, 1957-69 36
B-9. Company funds for R&D performance, by industry and selected company size groups, 1968 and 1969 37
B-10. Company-financed research and development contracted to outside organizations, by selected industry and company size groups, 1968 and 1969 38
B-11. Companies with 1,000 or more employees contracting research and development to outside organizations, by industry and size of company, 1969 39

Employment of R&D Scientists and Engineers

B-12. Full-time-equivalent number of R&D scientists and engineers, by industry and size of company, 1957-70 40
B-13. Full-time-equivalent number of R&D scientists and engineers, by industry and selected company size groups, January 1969 and January 1970 41
B-14. Man-years of R&D scientists and engineers, by size of company and R&D program, 1969 41
B-15. Man-years of R&D scientists and engineers, by industry and size of R&D program, 1969 42
B-16. Full-time-equivalent number of R&D scientists and engineers, by industry and source of funds for R&D projects, January 1969 and January 1970 43
B-17. Federal funds for R&D performance, by selected industry and agency, 1969 44
B-18. R&D scientists and engineers—man-years and cost, by source of funds and Federal agency, 1969 44
B-19. Number of R&D scientists and engineers per 1,000 employees, by industry and size of company, 1958-69 45

Distribution of R&D Funds, by Size of Company and R&D Program

B-20. R&D-performing companies in manufacturing and nonmanufacturing industries, by size of company, 1969 46
B-21. R&D-performing companies with 1,000 or more employees, by size of company and R&D program, 1969 46
B-22. Percent of total, Federal, and company funds of all R&D-performing manufacturing companies accounted for by the companies with the largest R&D programs, 1959-69 47
B-23. Percent of net sales and employment of all R&D-performing manufacturing companies accounted for by the companies with the largest R&D programs, 1959-69 47
B-24. Percent of total and Federal R&D performance funds and percent of net sales of all R&D-performing companies accounted for by the companies with the largest R&D programs, by industry, 1969 48
B-25. R&D-performing companies with 1,000 or more employees and number with Federal funds for R&D performance, by industry and size of company, 1969 49

Distribution of R&D Funds, by Major Type of Cost

B-26. Distribution of R&D costs, by industry and type of cost, 1969 50
B-27. Distribution of R&D costs, by industry and type of cost, 1968 51

Page

Funds for Research and for Development

B-28. Funds for basic research, applied research, and development performance, 1953–69 52
B-29. Funds for basic research, applied research, and development performance, by industry and selected company size groups, 1968 and 1969 53
B-30. Funds for basic research, applied research, and development performance, by industry, source, and selected company size groups, 1969 54
B-31. Funds for basic research performance, by industry and size of company, 1957–69 55
B-32. Funds for basic research performance, by industry and selected company size groups, 1968 and 1969 56
B-33. Funds for basic research performance, by field of science, 1967–69 57
B-34. Funds for basic research performance, by industry and field of science, 1969 58
B-35. R&D-performing companies with 5,000 or more employees and number performing basic research, by industry and size of company, 1969 59
B-36. Funds for applied research and development performance, by product field, 1959–69 60
B-37. Funds for applied research and development performance in companies with 5,000 or more employees, by product field and size of company, 1969 61
B-38. Funds for applied research and development performance, by selected product field and source, 1969 63
B-39. Funds for applied research and development performance, by industry and product field, 1969 64
B-40. Funds for applied research and development performance, by industry and product field, 1968 66
B-41. Funds for applied research and development performance, by industry and secondary product field, 1969 68
B-42. Funds for applied research and development performance, by industry and secondary product field, 1968 70

Geographic Distribution of R&D Funds

B-43. Geographic distribution of funds for industrial R&D performance, 1962–69 72
B-44. Geographic distribution of funds for industrial R&D performance, by source of funds, 1969 73

R&D Funds Related to Employment and Net Sales

B-45. Cost per R&D scientist or engineer, by industry and size of company, 1957–69 74
B-46. Cost per R&D scientist or engineer, by industry and selected company size groups, 1969 75
B-47. Cost per R&D scientist or engineer in manufacturing companies with the largest R&D programs, 1959–69 75
B-48. Total employment of R&D-performing companies, by industry and selected company size groups, 1968 and 1969 76
B-49. Total and company funds for R&D performance per employee, by size of company, 1959–69 77
B-50. Employees in R&D-performing companies and total and company funds for R&D performance per employee, by industry and selected company size groups, 1969 78
B-51. Net sales of R&D-performing manufacturing companies, by industry and selected company size groups, 1968 and 1969 79
B-52. Funds for R&D performance as percent of net sales in R&D-performing manufacturing companies, by industry and size of company, 1957–69 80
B-53. Company funds for R&D performance as percent of net sales in R&D-performing manufacturing companies, by industry and size of company, 1957–69 81
B-54. Funds for R&D performance as percent of net sales in R&D-performing manufacturing companies, by industry and selected company size groups, 1969 82
B-55. Company funds for R&D performance as percent of net sales in R&D-performing manufacturing companies, by industry and selected company size groups, 1969 83
B-56. Funds for R&D performance as percent of net sales in manufacturing companies with the largest R&D programs, by industry, 1969 84

IN ALL TABLES OF THIS REPORT—

- **Details may not add to totals because of rounding.**
- **Percentages were calculated on the basis of thousands of dollars and may differ from those based on the rounded figures shown.**
- **Percentage changes are increases unless otherwise indicated.**

TABLE B–1.—*Trends in funds for industrial R&D performance, by source, 1953–69*

[Dollars in millions]

Year	Total R&D		Federal		Company [a]	
	Amount	Percent change from previous year	Amount	Percent of total	Amount	Percent of total
1953	$3,630		$1,430	39	$2,200	61
1954 [b]	4,070	12	1,750	43	2,320	57
1955 [b]	4,640	14	2,180	47	2,460	53
1956	6,605	42	3,328	50	3,277	50
1957	7,731	17	4,335	56	3,396	44
1958	8,389	9	4,759	57	3,630	43
1959	9,618	15	5,635	59	3,983	41
1960	10,509	9	6,081	58	4,428	42
1961 [c]	10,908	4	6,240	57	4,668	43
1962	11,464	5	6,434	56	5,029	44
1963	12,630	10	7,270	58	5,360	42
1964	13,512	7	7,720	57	5,792	43
1965	14,185	5	7,740	55	6,445	45
1966	15,548	10	8,332	54	7,216	46
1967	16,415	6	8,395	51	8,020	49
1968	17,469	6	8,600	49	8,869	51
1969	18,474	6	8,619	47	9,856	53

[a] Company funds include all funds for industrial research and development performed within company facilities except funds provided by the Federal Government. The data do not include company-financed research and development contracted to outside organizations such as research institutions, universities and colleges, or other nonprofit organizations. In 1969 industrial firms contracted $279 million in company-financed R&D projects to outside organizations.

[b] Estimates of funds by source were derived by interpolating data on sources of funds obtained in the 1953 and 1956 surveys of industrial research and development.

[c] Funds by source estimated by the National Science Foundation.

TABLE B-2.—*Funds for R&D performance, by industry and size of company, 1956–69*

[Dollars in millions]

Industry and size of company	SIC code[a]	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
Total		$6,605	$7,731	$8,389	$9,618	$10,509	$10,908	$11,464	$12,630	$13,512	$14,185	$15,548	$16,415	$17,469	$18,474
Distribution by industry															
Food and kindred products	20	64	74	83	91	104	125	121	130	141	151	153	165	167	185
Textiles and apparel	22, 23	([b])	15	26	30	38	30	28	30	32	38	51	57	58	60
Lumber, wood products, and furniture	24, 25	([b])	14	12	12	10	10	10	11	12	12	13	14	22	24
Paper and allied products	26	36	35	42	49	56	59	65	69	71	77	88	83	93	113
Chemicals and allied products	28	641	705	792	891	980	1,101	1,175	1,239	1,300	1,390	1,461	1,569	1,658	1,752
Industrial chemicals	281–82	460	503	553	600	666	706	738	809	876	932	955	1,004	1,027	1,065
Drugs and medicines	283	94	104	128	154	162	180	195	216	238	274	318	356	394	437
Other chemicals	284–89	87	98	111	137	152	215	242	214	186	184	188	209	238	250
Petroleum refining and extraction	29, 13	182	211	246	278	296	299	310	317	410	434	430	455	539	572
Rubber products	30	([b])	107	89	115	121	138	141	156	159	166	178	200	230	240
Stone, clay, and glass products	32	[c] 60	[c] 69	[c] 75	[c] 81	88	88	96	100	110	117	128	156	164	191
Primary metals	33	90	108	131	152	177	177	171	183	195	213	232	242	251	267
Ferrous metals and products[d]	331–32, 3391, 3399	([b])	64	80	84	102	98	97	106	116	128	139	135	135	142
Nonferrous metals and products	333–36, 3392	([b])	44	51	68	75	79	74	77	79	85	93	107	115	125
Fabricated metal products	34	116	135	162	138	145	136	146	153	148	145	154	163	183	183
Machinery	35	543	669	781	930	949	901	914	958	1,051	1,128	1,300	1,457	1,614	1,746
Electrical equipment and communication	36, 48	1,516	1,804	1,969	2,329	2,532	2,483	2,639	2,866	2,952	3,168	3,586	3,798	4,049	4,294
Radio and TV receiving equipment	365	([e])	([e])	([e])	([e])	([e])	([e])	([e])	([e])	([e])	([e])	67	84	101	109
Communication equipment and electronic components	366–67, 48	([b])	748	868	1,162	1,324	1,404	1,591	1,773	1,837	1,918	2,149	2,241	2,321	2,454
Other electrical equipment	361–64, 369	([b])	1,056	1,101	1,167	1,208	1,079	1,048	1,093	1,115	1,250	1,370	1,473	1,627	1,731
Motor vehicles and other transportation equipment	371, 373–75, 379	688	707	856	866	884	936	999	1,090	1,176	1,223	1,339	1,376	1,518	1,647
Aircraft and missiles	372, 19	2,138	2,574	2,609	3,090	3,514	3,829	4,042	4,712	5,055	5,098	5,447	5,570	5,658	5,801
Professional and scientific instruments	38	200	249	294	309	329	297	309	284	324	383	434	492	600	664
Scientific and mechanical measuring instruments	381–82	97	139	156	159	160	119	101	70	73	76	76	85	87	87
Optical, surgical, photographic, and other instruments	383–87	103	110	138	150	169	178	208	214	251	308	357	407	513	576
Other manufacturing industries	21, 27, 31, 39	([b])	93	105	118	119	105	65	54	60	61	64	75	89	96
Nonmanufacturing industries	07–12, 14–17, 41–47, 49–67, 739, 807, 891	([b])	([b])	117	139	168	194	234	276	318	382	490	546	575	640
Distribution by size of company (based on number of employees)															
Less than 1,000		369	542	532	546	581	612	633	619	632	659	621	687	([b])	([b])
1,000 to 4,999		[c] 550	[c] 632	642	740	892	949	990	1,022	1,035	956	1,043	1,017	([b])	([b])
5,000 to 9,999		[c] 5,686	[c] 6,557	7,215	8,332	9,036	9,347	9,840	10,989	11,846	12,569	793	892	960	1,048
10,000 or more												13,092	13,820	14,820	15,660

---

[a] Industries, industry groups, and product fields shown separately in statistical tables are classified according to their *Standard Industrial Classification Manual* codes. See appendix A, footnote 3.

[b] Not separately available but included in total.

[c] Estimated by the National Science Foundation.

[d] SIC codes 3391 and 3399 included in the nonferrous metals and products group for 1956 to 1965.

[e] Included in the other electrical equipment group.

TABLE B–3.—*Funds for R&D performance, by industry and selected company size groups, 1969*

Industry	SIC code	Millions of dollars			Percent distribution		
		Total	Companies with total employment of—		Total	Companies with total employment of—	
			5,000 to 9,999	10,000 or more		5,000 to 9,999	10,000 or more
Total		$18,474	$1,048	$15,660	100	6	85
Food and kindred products	20	185	18	137	100	9	74
Textiles and apparel	22, 23	60	(a)	(a)	100	(a)	(a)
Lumber, wood products, and furniture	24, 25	24	(a)	(a)	100	(a)	(a)
Paper and allied products	26	113	11	85	100	9	75
Chemicals and allied products	28	1,752	234	1,265	100	13	72
Industrial chemicals	281–82	1,065	10	980	100	1	92
Drugs and medicines	283	437	168	174	100	38	40
Other chemicals	284–89	250	56	111	100	23	44
Petroleum refining and extraction	29, 13	572	22	532	100	4	93
Rubber products	30	240	35	176	100	15	74
Stone, clay, and glass products	32	191	17	151	100	9	79
Primary metals	33	267	22	197	100	8	74
Ferrous metals and products	331–32, 3391, 3399	142	(a)	119	100	(a)	84
Nonferrous metals and products	333–36, 3392	125	(a)	78	100	(a)	63
Fabricated metal products	34	183	26	96	100	14	52
Machinery	35	1,746	76	1,479	100	4	85
Electrical equipment and communication	36, 48	4,294	239	3,762	100	6	88
Radio and TV receiving equipment	365	109	--------	100	100	--------	92
Communication equipment and electronic components	366–67, 48	2,454	(a)	(a)	100	(a)	(a)
Other electrical equipment	361–64, 369	1,731	(a)	(a)	100	(a)	(a)
Motor vehicles and other transportation equipment	371, 373–75, 379	1,647	17	1,610	100	1	98
Aircraft and missiles	372, 19	5,801	62	5,656	100	1	98
Professional and scientific instruments	38	664	186	395	100	28	59
Scientific and mechanical measuring instruments	381–82	87	(a)	(a)	100	(a)	(a)
Optical, surgical, photographic, and other instruments	383–87	576	(a)	(a)	100	(a)	(a)
Other manufacturing industries	21, 27, 31, 39	96	18	49	100	19	50
Nonmanufacturing industries	07–12, 14–17, 41–47, 49–67, 739, 807, 891	640	57	31	100	9	5

[a] Not separately available but included in total.

TABLE B-4.—*Funds for R&D performance, by industry and selected company size groups, 1968*

Industry	SIC code	Millions of dollars			Percent distribution		
		Total	Companies with total employment of—		Total	Companies with total employment of—	
			5,000 to 9,999	10,000 or more		5,000 to 9,999	10,000 or more
Total		$17,469	$960	$14,820	100	5	85
Food and kindred products	20	167	17	124	100	10	74
Textiles and apparel	22, 23	58	(a)	(a)	100	(a)	(a)
Lumber, wood products, and furniture	24, 25	22	(a)	(a)	100	(a)	(a)
Paper and allied products	26	93	10	67	100	11	72
Chemicals and allied products	28	1,658	210	1,215	100	13	73
Industrial chemicals	281–82	1,027	9	948	100	1	92
Drugs and medicines	283	394	149	159	100	38	40
Other chemicals	284–89	238	52	109	100	22	46
Petroleum refining and extraction	29, 13	539	19	503	100	4	93
Rubber products	30	230	37	166	100	16	72
Stone, clay, and glass products	32	164	15	125	100	9	77
Primary metals	33	251	21	185	100	8	74
Ferrous metals and products	331–32, 3391, 3399	135	(a)	113	100	(a)	84
Nonferrous metals and products	333–36, 3392	115	(a)	71	100	(a)	62
Fabricated metal products	34	183	24	102	100	13	56
Machinery	35	1,614	67	1,360	100	4	84
Electrical equipment and communication	36, 48	4,049	221	3,526	100	5	87
Radio and TV receiving equipment	365	101	--------	92	100	--------	92
Communication equipment and electronic components	366–67, 48	2,321	(a)	(a)	100	(a)	(a)
Other electrical equipment	361–64, 369	1,627	(a)	(a)	100	(a)	(a)
Motor vehicles and other transportation equipment	371, 373–75, 379	1,518	16	1,478	100	1	97
Aircraft and missiles	372, 19	5,658	70	5,500	100	1	97
Professional and scientific instruments	38	600	159	360	100	27	60
Scientific and mechanical measuring instruments	381–82	87	(a)	(a)	100	(a)	(a)
Optical, surgical, photographic, and other instruments	383–87	513	(a)	(a)	100	(a)	(a)
Other manufacturing industries	21, 27, 31, 39	89	16	46	100	18	52
Nonmanufacturing industries	07–12, 14–17, 41–47, 49–67, 739, 807, 891	575	50	26	100	9	4

---

[a] Not separately available but included in total.

TABLE B-5.—*Funds for R&D performance, by industry, size of company, and size of R&D program, 1969*

Industry and size of company	SIC code	Total	Size of R&D program (thousands of dollars)				
			Less than $200	$200–$999	$1,000–$9,999	$10,000–$99,999	$100,000 or more
			Millions of dollars				
Total	--------	$18,474	$ [b]237	$337	$1,834	$4,415	$11,652
Distribution by industry							
Food and kindred products	20	185	5	12	(a)	(a)	--------
Textiles and apparel	22, 23	60	8	13	38	--------	--------
Lumber, wood products, and furniture	24, 25	24	6	3	15	--------	--------
Paper and allied products	26	113	2	11	69	32	--------
Chemicals and allied products	28	1,752	34	22	278	(a)	(a)
Industrial chemicals	281–82	1,065	9	7	114	(a)	(a)
Drugs and medicines	283	437	11	4	(a)	(a)	--------
Other chemicals	284–89	250	13	11	(a)	(a)	--------
Petroleum refining and extraction	29, 13	572	3	7	53	(a)	(a)
Rubber products	30	240	7	9	35	188	--------
Stone, clay, and glass products	32	191	14	10	43	125	--------
Primary metals	33	267	6	17	108	136	--------
Ferrous metals and products	331–32, 3391, 3399	142	3	9	(a)	(a)	--------
Nonferrous metals and products	333–36, 3392	125	3	8	(a)	(a)	--------
Fabricated metal products	34	183	15	26	45	97	--------
Machinery	35	1,746	47	54	225	(a)	(a)
Electrical equipment and communication	36, 48	4,294	38	65	248	936	3,008
Radio and TV receiving equipment	365	109	3	(a)	(a)	(a)	--------
Communication equipment and electronic components	366–67, 48	2,454	17	22	140	(a)	(a)
Other electrical equipment	361–64, 369	1,731	19	(a)	(a)	(a)	(a)
Motor vehicles and other transportation equipment	371, 373–75, 379	1,647	4	6	58	85	1,494
Aircraft and missiles	372, 19	5,801	7	4	69	305	5,416
Professional and scientific instruments	38	664	13	24	110	(a)	(a)
Scientific and mechanical measuring instruments	381–82	87	7	15	(a)	(a)	--------
Optical, surgical, photographic, and other instruments	383–87	576	7	9	(a)	(a)	(a)
Other manufacturing industries	21, 27, 31, 39	96	6	9	(a)	(a)	--------
Nonmanufacturing industries	07–12, 14–17, 41–47, 49–67, 739, 807, 891	640	23	43	251	324	--------
Distribution by size of company (based on number of employees)							
Less than 1,000	--------	718	208	169	300	43	--------
1,000 to 4,999	--------	1,048	26	132	561	329	--------
5,000 to 9,999	--------	1,048	2	25	397	625	--------
10,000 or more	--------	15,660	2	12	577	3,418	11,652

---

[a] Not separately available but included in total.

[b] Estimated. Those companies that reported less than $200,000 in R&D expenditures in 1968 were not participants in the 1969 survey, but their R&D activities are estimated by the Bureau of the Census at the 1968 level.

TABLE B-6.—*Federal funds for R&D performance, by industry and size of company, 1957–69*

[Dollars in millions]

Industry and size of company	SIC code	1957	1958	1959	1960	1961 [a]	1962	1963	1964	1965	1966	1967	1968	1969
Total		$4,335	$4,759	$5,635	$6,081	$6,240	$6,434	$7,270	$7,720	$7,740	$8,332	$8,395	$8,600	$8,619
Distribution by industry														
Food and kindred products	20	(b)	6	5	9	5	3	(c)	1	1	1	1	1	2
Textiles and apparel	22, 23			7	9	(c)	(c)	(c)	(c)	(c)	(c)	(c)	(c)	(c)
Lumber, wood products, and furniture	24, 25			2	1	(c)	(c)	(c)	(c)	(c)		(c)		
Paper and allied products	26	(b)			(c)	(c)					(c)	(c)	(c)	(c)
Chemicals and allied products	28	89	126	147	171	221	236	234	202	191	190	211	201	192
Industrial chemicals	281–82	80	110	102	121	128	139	146	140	148	159	182	174	169
Drugs and medicines	283	(b)	2	3	4	3	4	9	(c)	(c)	(c)	(c)	(c)	(c)
Other chemicals	284–89	9	14	32	46	90	93	79	(c)	(c)	(c)	(c)	(c)	(c)
Petroleum refining and extraction	29, 13	11	12	27	20	19	20	21	72	69	47	46	71	47
Rubber products	30	37	21	39	38	40	36	46	35	25	26	35	41	43
Stone, clay, and glass products	32	(c)	(d)	(d)	(c)	(c)	4	3	4	4	6	7	5	4
Primary metals	33	5	14	12	15	18	11	10	8	8	8	8	9	10
Ferrous metals and products [e]	331–32, 3391, 3399	1	2	1	3	4	2	2	2	1	3	1	1	1
Nonferrous metals and products	333–36, 3392	4	12	11	12	14	9	8	6	7	5	6	8	9
Fabricated metal products	34	38	57	44	36	38	25	24	19	15	17	13	18	11
Machinery	35	272	343	411	391	313	270	250	263	267	326	381	416	390
Electrical equipment and communication	36, 48	1,196	1,337	1,642	1,675	1,596	1,691	1,849	1,858	1,963	2,173	2,246	2,296	2,329
Radio and TV receiving equipment	365	(f)	(f)	(f)	(f)	(f)	(f)	(f)	(f)	(f)	(c)	(c)	(c)	(c)
Communication equipment and electronic components	366–67, 48	518	615	855	944	934	1,074	1,209	1,233	1,241	1,349	1,349	1,364	1,390
Other electrical equipment	361–64, 369	678	722	787	741	662	617	640	625	721	(c)	(c)	(c)	(c)
Motor vehicles and other transportation equipment	371, 373–75, 379	190	296	221	216	225	282	291	322	325	344	389	412	406
Aircraft and missiles	372, 19	2,275	2,276	2,754	3,150	3,438	3,588	4,261	4,610	4,476	4,695	4,499	4,506	4,524
Professional and scientific instruments	38	109	137	144	153	116	107	81	94	126	135	172	212	215
Scientific and mechanical measuring instruments	381–82	80	93	96	97	58	38	16	19	19	16	23	17	15
Optical, surgical, photographic, and other instruments	383–87	29	44	48	56	58	69	65	75	107	119	148	195	200
Other manufacturing industries [g]	21, 27, 31, 39	(c)	134	89	72	61	8	3	1	1	(c)		(c)	(c)
Nonmanufacturing industries	07–12, 14–17, 41–47, 49–67, 739, 807, 891			92	110	(c)	152	190	228	266	361	375	405	440
Distribution by size of company (based on number of employees)														
Less than 1,000		167	233	(c)	(c)	(c)	(c)	194	215	224	234	228	(c)	(c)
1,000 to 4,999		226	[a] 202	263	347	359	385	425	432	378	385	351	(c)	(c)
5,000 to 9,999		3,942	[a] 4,324	5,091	5,441	5,580	5,821	6,651	7,072	7,138	182	251	299	315
10,000 or more											7,530	7,566	7,702	7,714

---

[a] Estimated by the National Science Foundation.

[b] Less than $0.5 million.

[c] Not separately available but included in total.

[d] Data included in the other manufacturing industries group.

[e] SIC codes 3391 and 3399 included in the nonferrous metals and products group for 1957 to 1965.

[f] Included in the other electrical equipment group.

[g] Data for 1957 and 1958 include textiles and apparel; lumber, wood products, and furniture; and nonmanufacturing industries.

TABLE B-7.—*Federal funds for R&D performance, by industry and selected company size groups, 1968 and 1969*

[Dollars in millions]

Industry	SIC code	1968			1969		
		Federal funds	Companies with total employment of—		Federal funds	Companies with total employment of—	
			5,000 to 9,999	10,000 or more		5,000 to 9,999	10,000 or more
Total	--------	$8,600	$299	$7,702	$8,619	$315	$7,714
Food and kindred products	20	1	(a)	(a)	2	(a)	(a)
Textiles and apparel	22, 23	(a)	(a)	(a)	(a)	(a)	(a)
Lumber, wood products, and furniture	24, 25	--------	--------	--------	--------	--------	--------
Paper and allied products	26	(a)	--------	(a)	(a)	--------	(a)
Chemicals and allied products	28	201	3	192	192	3	184
Petroleum refining and extraction	29, 13	71	--------	71	47	--------	47
Rubber products	30	41	(a)	14	43	(a)	16
Stone, clay, and glass products	32	5	(a)	(a)	4	(a)	(a)
Primary metals	33	9	2	6	10	2	8
Fabricated metal products	34	18	--------	18	11	--------	11
Machinery	35	416	(a)	400	390	(a)	382
Electrical equipment and communication	36, 48	2,296	(a)	2,080	2,329	(a)	2,130
Radio and TV receiving equipment	365	(a)	--------	(a)	(a)	--------	(a)
Communication equipment and electronic components	366–67, 48	1,364	(a)	(a)	1,390	(a)	(a)
Other electrical equipment	361–64, 369	(a)	(a)	(a)	(a)	(a)	(a)
Motor vehicles and other transportation equipment	371, 373–75, 379	412	5	396	406	5	393
Aircraft and missiles	372, 19	4,506	44	4,401	4,524	40	4,428
Professional and scientific instruments	38	212	85	115	215	96	107
Other manufacturing industries	21, 27, 31, 39	(a)	--------	--------	(a)	--------	--------
Nonmanufacturing industries	07–12, 14–17, 41–47, 49–67, 739, 807, 891	405	(a)	(a)	440	(a)	(a)

---

[a] Not separately available but included in total.

TABLE B-8.—*Company funds for R&D performance, by industry and size of company, 1957–69*[a]

[Dollars in millions]

Industry and size of company	SIC code	1957	1958	1959	1960	1961 [b]	1962	1963	1964	1965	1966	1967	1968	1969
Total		$3,396	$3,630	$3,983	$4,428	$4,668	$5,029	$5,360	$5,792	$6,445	$7,216	$8,020	$8,869	$9,856
Distribution by industry														
Food and kindred products	20	74	77	86	95	120	119	(c)	140	150	151	164	166	183
Textiles and apparel	22, 23	14	20	23	29	(c)	(c)	28	(c)	(c)	(c)	(c)	(c)	(c)
Lumber, wood products, and furniture	24, 25	14	12	10	9	(c)	(c)	(c)	(c)	(c)	13	14	22	24
Paper and allied products	26	35	42	49	(c)	(c)	65	69	71	77	(c)	83	(c)	(c)
Chemicals and allied products	28	616	666	743	807	881	939	1,004	1,098	1,198	1,271	1,357	1,458	1,560
Industrial chemicals	281–82	423	443	488	544	578	599	662	736	784	796	822	853	895
Drugs and medicines	283	104	126	151	158	177	191	207	(c)	(c)	(c)	(c)	(c)	(c)
Other chemicals	284–89	89	97	104	105	126	149	135	(c)	(c)	(c)	(c)	(c)	(c)
Petroleum refining and extraction	29, 13	200	234	252	276	280	289	296	338	364	383	409	468	524
Rubber products	30	70	68	76	83	97	104	111	124	141	153	165	190	196
Stone, clay, and glass products	32	(c)	(c)	(c)	(c)	78	91	97	106	113	122	149	158	187
Primary metals	33	103	117	140	162	159	160	174	196	205	224	234	241	257
Ferrous metals and products [d]	331–32, 3391, 3399	63	78	83	99	94	95	105	114	127	136	134	134	141
Nonferrous metals and products	333–36, 3392	40	39	57	63	65	65	69	72	78	88	100	108	116
Fabricated metal products	34	97	105	94	109	98	121	129	129	129	137	151	165	172
Machinery	35	397	438	520	558	588	644	709	788	860	974	1,066	1,197	1,356
Electrical equipment and communication	36, 48	608	632	688	847	887	949	1,017	1,093	1,206	1,414	1,552	1,753	1,965
Radio and TV receiving equipment	365	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(c)	(c)	(c)
Communication equipment and electronic components	366–67, 48	230	253	308	380	470	517	564	604	677	800	891	956	1,064
Other electrical equipment	361–64, 369	378	379	380	467	417	432	453	489	529	(c)	(c)	(c)	(c)
Motor vehicles and other transportation equipment	371, 373–75, 379	517	560	646	668	711	718	799	854	898	995	986	1,106	1,241
Aircraft and missiles	372, 19	299	333	335	364	392	454	452	445	622	753	1,070	1,152	1,277
Professional and scientific instruments	38	140	157	165	176	180	202	202	229	257	298	321	388	448
Scientific and mechanical measuring instruments	381–82	59	63	63	63	60	63	53	54	57	61	62	70	72
Optical, surgical, photographic, and other instruments	383–87	81	94	102	113	120	139	149	176	200	238	259	318	376
Other manufacturing industries	21, 27, 31, 39	(c)	39	29	47	44	56	52	59	60	(c)	75	(c)	(c)
Nonmanufacturing industries	07–12, 14–17, 41–47, 49–67, 739, 807, 891	(c)	55	48	58	(c)	83	85	90	116	129	171	170	200
Distribution by size of company (based on number of employees)														
Less than 1,000		375	299	(c)	(c)	(c)	421	425	417	435	387	459	(c)	(c)
1,000 to 4,999		[b] 406	[b] 440	477	545	590	599	596	602	579	657	666	(c)	(c)
5,000 to 9,999		[b] 2,615	[b] 2,891	3,241	3,595	3,767	4,009	4,338	4,773	5,431	611	642	661	734
10,000 or more											5,561	6,254	7,118	7,947

[a] See table 1, footnote a.

[b] Estimated by the National Science Foundation.

[c] Not separately available but included in total.

[d] SIC codes 3391 and 3399 included in the nonferrous metals and products group for 1957 to 1965.

[e] Included in the other electrical equipment group.

Table B-9.—*Company funds for R&D performance, by industry and selected company size groups, 1968 and 1969*

[Dollars in millions]

Industry	SIC code	1968			1969		
		Company funds	Companies with total employment of—		Company funds	Companies with total employment of—	
			5,000 to 9,999	10,000 or more		5,000 to 9,999	10,000 or more
Total		$8,869	$661	$7,118	$9,856	$734	$7,947
Food and kindred products	20	166	(a)	(a)	183	(a)	(a)
Textiles and apparel	22, 23	(a)	(a)	(a)	(a)	(a)	(a)
Lumber, wood products, and furniture	24, 25	22	(a)	(a)	24	(a)	(a)
Paper and allied products	26	(a)	10	(a)	(a)	11	(a)
Chemicals and allied products	28	1,458	206	1,023	1,560	231	1,082
Petroleum refining and extraction	29, 13	468	19	433	524	22	484
Rubber products	30	190	(a)	152	196	(a)	160
Stone, clay, and glass products	32	158	(a)	(a)	187	(a)	(a)
Primary metals	33	241	19	179	257	20	190
Fabricated metal products	34	165	24	84	172	26	85
Machinery	35	1,197	(a)	960	1,356	(a)	1,098
Electrical equipment and communication	36, 48	1,753	(a)	1,446	1,965	(a)	1,632
Radio and TV receiving equipment	365	(a)	--------	(a)	(a)	--------	(a)
Communication equipment and electronic components	366–67, 48	956	(a)	(a)	1,064	(a)	(a)
Other electrical equipment	361–64, 369	(a)	(a)	(a)	(a)	(a)	(a)
Motor vehicles and other transportation equipment	371, 373–75, 379	1,106	10	1,083	1,241	11	1,217
Aircraft and missiles	372, 19	1,152	26	1,098	1,277	23	1,227
Professional and scientific instruments	38	388	75	245	448	90	287
Other manufacturing industries	21, 27, 31, 39	(a)	16	46	(a)	18	49
Nonmanufacturing industries	07–12, 14–17, 41–47, 49–67, 739, 807, 891	170	(a)	(a)	200	(a)	(a)

[a] Not separately available but included in total.

Table B–10.—*Company-financed research and development contracted to outside organizations, by selected industry and company size groups, 1968 and 1969*

[Dollars in millions]

Industry and size of company	SIC code	1968	1969
Total		$229	$279
Distribution by industry			
Food and kindred products	20	5	5
Chemicals and allied products	28	55	61
Industrial chemicals	281–82	13	16
Drugs and medicines	283	34	34
Other chemicals	284–89	9	11
Petroleum refining and extraction	29, 13	9	12
Stone, clay, and glass products	32	6	7
Primary metals	33	15	17
Ferrous metals and products	331–32, 3391, 3399	3	4
Nonferrous metals and products	333–36, 3392	12	14
Machinery	35	13	17
Electrical equipment and communication	36, 48	9	9
Professional and scientific instruments	38	4	5
Other manufacturing industries	21, 27, 31, 39	6	5
Nonmanufacturing industries	07–12, 14–17, 41–47, 49–67, 739, 807, 891	41	45
Distribution by size of company (based on number of employees)			
5,000 to 9,999		28	28
10,000 or more		119	157

TABLE B-11.—*Companies with 1,000 or more employees*[a] *contracting research and development to outside organizations, by industry and size of company, 1969*

Industry	SIC code	Companies with total employment of—											
		1,000 or more			1,000 to 4,999			5,000 to 9,999			10,000 or more		
		Total	Contracting outside	Percent of total	Total	Contracting outside	Percent of total	Total	Contracting outside	Percent of total	Total	Contracting outside	Percent of total
Total		1,331	559	42	[b] 814	285	35	211	99	47	306	174	57
Food and kindred products	20	102	51	50	59	29	49	16	8	50	27	14	52
Textiles and apparel	22, 23	71	17	23	48	10	20	7	2	29	16	5	31
Lumber, wood products, and furniture	24, 25	28	4	14	19	1	5	5	2	40	4	1	25
Paper and allied products	26	51	29	57	26	14	54	9	4	44	16	11	69
Chemicals and allied products	28	107	71	66	54	28	52	21	15	71	32	28	88
Industrial chemicals	281-82	42	27	64	17	7	41	3	1	33	22	19	86
Drugs and medicines	283	27	23	85	12	10	83	9	7	78	6	6	100
Other chemicals	284-89	38	21	55	25	11	44	9	7	78	4	3	75
Petroleum refining and extraction	29, 13	35	21	60	11	4	36	6	2	33	18	15	83
Rubber products	30	33	11	33	21	6	28	6	2	33	6	3	50
Stone, clay, and glass products	32	46	20	43	28	5	18	8	6	75	10	9	90
Primary metals	33	82	40	49	44	20	45	16	5	31	22	15	68
Ferrous metals and products	331-32, 3391, 3399	45	20	44	22	10	45	10	2	20	13	8	62
Nonferrous metals and products	333-36, 3392	37	20	54	22	10	45	6	3	50	9	7	78
Fabricated metal products	34	73	25	34	53	15	27	11	4	36	9	6	67
Machinery	35	171	48	28	114	24	21	24	10	44	33	14	42
Electrical equipment and communication	36, 48	151	46	31	92	22	24	24	10	42	35	14	40
Radio and TV receiving equipment	365	7	1	14	3	1	33	-------	-------	-------	4	-------	-------
Communication equipment and electronic components	366-67, 48	67	14	21	37	5	14	12	2	17	18	7	39
Other electrical equipment	361-64, 369	77	31	41	52	16	31	12	8	67	13	7	54
Motor vehicles and other transportation equipment	371, 373-75, 379	48	15	32	23	4	19	8	3	38	17	8	47
Aircraft and missiles	372, 19	45	19	41	20	8	38	4	1	25	21	10	48
Professional and scientific instruments	38	54	18	33	32	11	34	13	5	38	9	2	22
Scientific and mechanical measuring instruments	381-82	24	10	42	17	7	41	5	3	60	2	-------	-------
Optical, surgical, photographic, and other instruments	383-87	30	8	27	15	4	27	8	2	25	7	2	29
Other manufacturing industries	21, 27, 31, 39	63	23	36	44	12	26	11	5	45	8	6	75
Nonmanufacturing industries	07-12, 14-17, 41-47, 49-67, 739, 807, 891	171	101	59	126	73	58	22	15	68	23	13	57

---

[a] Data not available for companies with less than 1,000 employees.

[b] 44 percent of this number is represented by companies that reported less than $200,000 in R&D expenditures in 1968. See table 5, footnote *b*.

TABLE B-12.—*Full-time-equivalent number of R&D scientists and engineers, by industry and size of company, 1957–70*

Industry and size of company	SIC code	January 1957	January 1958	January 1959	January 1960	January 1961	January 1962	January 1963	January 1964	January 1965	January 1966	January 1967	January 1968	January 1969	January 1970
Total		229, 400	243, 800	268, 400	292, 000	312, 100	312, 000	327, 300	340, 200	343, 600	353, 200	367, 200	376, 700	387, 100	380, 600
Distribution by industry															
Food and kindred products	20	3, 800	4, 800	5, 100	4, 700	5, 200	5, 400	5, 100	5, 300	5, 700	5, 700	5, 500	5, 700	5, 700	6, 000
Textiles and apparel	22, 23	700	800	1, 000	1, 000	1, 100	([a])	1, 000	1, 200	1, 200	1, 400	1, 900	2, 500	2, 600	2, 600
Lumber, wood products, and furniture	24, 25	800	800	1, 000	700	500	600	500	500	600	600	600	600	1, 100	1, 100
Paper and allied products	26	1, 500	1, 700	2, 000	2, 400	2, 600	2, 600	2, 500	2, 600	2, 400	2, 600	2, 800	2, 800	2, 700	2, 900
Chemicals and allied products	28	29, 400	31, 000	33, 500	36, 100	37, 000	36, 500	38, 300	37, 800	40, 000	40, 000	38, 700	40, 800	42, 200	42, 000
Industrial chemicals	281–82	18, 000	18, 800	20, 200	21, 800	22, 900	21, 600	22, 900	23, 600	25, 700	24, 700	22, 700	23, 300	23, 600	23, 000
Drugs and medicines	283	4, 700	5, 100	5, 900	6, 000	6, 200	6, 800	6, 900	7, 300	7, 700	8, 000	9, 300	10, 000	10, 300	11, 000
Other chemicals	284–89	6, 700	7, 100	7, 400	8, 300	7, 900	8, 100	8, 500	6, 900	6, 600	7, 400	6, 700	7, 500	8, 300	8, 000
Petroleum refining and extraction	29, 13	6, 900	7, 400	7, 700	9, 200	9, 000	9, 100	8, 900	9, 000	9, 700	10, 200	10, 400	11, 200	11, 900	11, 800
Rubber products	30	4, 700	4, 700	4, 800	5, 300	5, 500	5, 600	5, 800	6, 000	5, 800	5, 700	5, 800	6, 100	6, 300	6, 400
Stone, clay, and glass products	32	([b])	([b])	([b])	([b])	3, 600	3, 700	3, 800	3, 900	4, 300	4, 200	4, 500	5, 400	5, 500	5, 700
Primary metals	33	5, 100	5, 200	5, 700	6, 900	6, 900	6, 000	5, 200	5, 100	5, 500	5, 500	5, 900	5, 900	6, 200	6, 500
Ferrous metals and products [c]	331–32, 3391, 3399	2, 900	3, 000	3, 500	3, 800	3, 900	3, 000	2, 900	2, 800	3, 200	3, 200	3, 300	3, 100	3, 200	3, 300
Nonferrous metals and products	333–36, 3392	2, 200	2, 200	2, 200	3, 000	3, 000	3. 000	2, 300	2, 300	2, 300	2, 300	2, 500	2, 700	3, 000	3, 200
Fabricated metal products	34	8, 400	8, 300	8, 900	7, 400	8, 600	7, 400	6, 800	7, 000	6, 600	6, 300	6, 300	5, 600	6, 600	6, 000
Machinery	35	24. 900	27, 400	29, 400	32, 100	33, 000	31, 500	31, 400	30, 500	32, 500	33, 600	38, 300	40, 200	42, 800	44, 100
Electrical equipment and communication	36, 48	42, 900	47, 900	54, 800	72, 100	79, 200	82, 300	85, 800	87, 700	86, 000	90, 600	96, 000	97, 800	100, 500	101, 200
Radio and TV receiving equipment	365	([d])	([d])	([d])	([d])	([d])	([d])	([d])	([d])	([d])	([d])	1, 600	1, 900	2, 100	2, 100
Communication equipment and electronic components	366–67, 48	19, 200	22, 300	27, 900	40, 800	47, 500	52, 600	55, 100	56, 700	55, 100	58, 100	60, 900	61, 900	62, 400	63, 100
Other electrical equipment	361–64, 369	23, 700	25, 600	26, 900	31, 300	31, 700	29, 700	30, 700	31, 000	30, 900	32, 600	33, 500	34, 000	36, 100	36, 000
Motor vehicles and other transportation equipment	371, 373–75, 379	13, 600	15, 000	16, 800	17, 800	19, 100	20, 800	21. 100	23, 000	23, 900	24, 600	25, 000	24, 000	24, 700	23, 700
Aircraft and missiles	372, 19	58, 700	58, 600	65, 900	72, 400	78, 500	79, 400	90, 700	99, 400	97, 400	97, 200	98, 300	98, 700	97, 600	90, 000
Professional and scientific instruments	38	10, 200	11, 000	12, 000	10, 000	11, 100	9, 800	9, 400	9, 700	10, 300	11, 200	11, 400	12, 500	13, 400	13, 300
Scientific and mechanical measuring instruments	381–82	5, 800	6, 500	7, 000	5, 500	5, 700	4, 800	3, 900	3, 700	3, 400	3, 600	3, 200	3, 400	3, 400	3, 300
Optical, surgical, photographic, and other instruments	383–87	4, 400	4, 500	5, 000	4, 500	5, 400	5, 000	5, 500	6, 000	6, 800	7, 600	8, 300	9, 100	10, 000	10, 100
Other manufacturing industries	21, 27, 31, 39	[e] 17, 800	[e] 19, 200	[e] 19, 800	[e] 13, 800	3, 500	3, 100	2, 800	2, 000	2, 400	2, 300	2, 200	2, 400	2, 800	2, 700
Nonmanufacturing industries	07–12, 14–17, 41–47, 49–67, 739, 807, 891					7, 500	7, 000	8, 200	9, 600	9, 400	11, 300	13, 600	14, 500	14, 500	14, 600
Distribution by size of company (based on number of employees)															
Less than 1,000		44, 800	48, 800	39, 600	39, 200	42, 100	36, 400	34, 100	32, 500	32, 400	30, 000	27, 400	27, 200	([a])	([a])
1,000 to 4,999		22, 400	24, 000	27, 100	29, 800	34, 000	35, 300	35, 000	34. 500	32, 100	30, 100	30, 500	29, 900	([a])	([a])
5,000 to 9,999		162, 200	171, 000	201, 700	223, 000	236, 000	240, 300	258, 200	273, 200	279, 100	293, 100	24, 000	24, 600	24, 600	25, 100
10,000 or more												285, 300	295, 000	307, 300	300, 700

---

[a] Not separately available but included in total.

[b] Data included in the other manufacturing industries group.

[c] SIC codes 3391 and 3399 included in the nonferrous metals and products group for January 1957 to January 1966.

[d] Included in the other electrical equipment group.

[e] Other manufacturing industries and nonmanufacturing industries combined.

TABLE B-13.—*Full-time-equivalent number of R&D scientists and engineers, by industry and selected company size groups, January 1969 and January 1970*

Industry	SIC code	January 1969			January 1970		
		Total	Companies with total employment of—		Total	Companies with total employment of—	
			5,000 to 9,999	10,000 or more		5,000 to 9,999	10,000 or more
Total		387,100	24,600	307,300	380,600	25,100	300,700
Food and kindred products	20	5,700	500	4,200	6,000	500	4,500
Textiles and apparel	22, 23	2,600	(a)	(a)	2,600	(a)	(a)
Lumber, wood products, and furniture	24, 25	1,100	(a)	(a)	1,100	(a)	(a)
Paper and allied products	26	2,700	400	1,700	2,900	300	2,000
Chemicals and allied products	28	42,200	5,900	28,300	42,000	6,300	27,700
Industrial chemicals	281–82	23,600	200	21,200	23,000	300	20,600
Drugs and medicines	283	10,300	3,900	3,900	11,000	4,200	4,200
Other chemicals	284–89	8,300	1,700	3,300	8,000	1,800	2,900
Petroleum refining and extraction	29, 13	11,900	500	10,600	11,800	700	10,300
Rubber products	30	6,300	800	4,300	6,400	900	4,300
Stone, clay, and glass products	32	5,500	400	4,000	5,700	500	4,200
Primary metals	33	6,200	600	4,200	6,500	600	4,500
Ferrous metals and products	331–32, 3391, 3399	3,200	(a)	2,500	3,300	(a)	2,600
Nonferrous metals and products	333–36, 3392	3,000	(a)	1,700	3,200	(a)	1,900
Fabricated metal products	34	6,600	1,200	3,200	6,000	1,200	2,700
Machinery	35	42,800	1,900	33,700	44,100	1,900	35,000
Electrical equipment and communication	36, 48	100,500	6,000	84,800	101,200	5,700	85,800
Radio and TV receiving equipment	365	2,100	--------	1,800	2,100	--------	1,800
Communication equipment and electronic components	366–67, 48	62,400	4,400	53,100	63,100	4,100	54,000
Other electrical equipment	361–64, 369	36,100	1,600	29,900	36,000	1,500	30,000
Motor vehicles and other transportation equipment	371, 373–75, 379	24,700	600	23,600	23,700	600	22,500
Aircraft and missiles	372, 19	97,600	1,600	93,500	90,000	1,300	86,300
Professional and scientific instruments	38	13,400	2,600	7,300	13,300	2,800	7,100
Other manufacturing industries	21, 27, 31, 39	2,800	500	1,400	2,700	500	1,300
Nonmanufacturing industries	07–12, 14–17, 41–47, 49–67, 739, 807, 891	14,500	900	1,000	14,600	1,000	1,000

[a] Not separately available but included in total.

TABLE B-14.—*Man-years of R&D scientists and engineers, by size of company and R&D program, 1969*

Size of company (based on number of employees)	Total	Size of R&D program (thousands of dollars)				
		Less than $200	$200–$999	$1,000–$9,999	$10,000–$99,999	$100,000 or more
Total	383,200	[a] 13,800	11,500	53,800	100,000	104,100
Less than 1,000	26,200	12,300	5,500	7,400	900	----------
1,000 to 4,999	28,700	1,300	4,600	16,700	6,100	----------
5,000 to 9,999	24,800	100	900	11,900	12,000	----------
10,000 or more	303,500	100	400	17,800	81,100	204,100

[a] Estimated. See table 5, footnote *b*.

TABLE B–15.—*Man-years of R&D scientists and engineers, by industry and size of R&D program, 1969*

Industry	SIC code	Total	Size of R&D program (thousands of dollars)				
			Less than $200	$200–$999	$1,000–$9,999	$10,000–$99,999	$100,000 or more
Total		383,200	[b]13,800	11,500	53,800	100,000	204,100
Food and kindred products	20	5,900	300	400	([a])	([a])	--------
Textiles and apparel	22, 23	2,600	900	500	1,200	--------	--------
Lumber, wood products, and furniture	24, 25	1,100	200	100	800	--------	--------
Paper and allied products	26	2,800	100	300	1,700	600	--------
Chemicals and allied products	28	42,000	1,500	900	8,500	([a])	([a])
Industrial chemicals	281–82	23,200	200	300	3,500	([a])	([a])
Drugs and medicines	283	10,600	200	100	([a])	([a])	--------
Other chemicals	284–89	8,200	1,000	500	([a])	([a])	--------
Petroleum refining and extraction	29, 13	11,800	100	300	1,400	([a])	([a])
Rubber products	30	6,300	600	300	1,000	4,400	--------
Stone, clay, and glass products	32	5,600	800	300	1,100	3,400	--------
Primary metals	33	6,300	300	600	2,500	2,900	--------
Ferrous metals and products	331–32, 3391, 3399	3,300	200	200	([a])	([a])	--------
Nonferrous metals and products	333–36, 3392	3,100	200	400	([a])	([a])	--------
Fabricated metal products	34	6,200	700	900	1,600	3,100	--------
Machinery	35	43,400	2,800	1,700	5,900	([a])	([a])
Electrical equipment and communication	36, 48	100,700	2,100	2,300	7,600	23,100	65,500
Radio and TV receiving equipment	365	2,100	100	([a])	([a])	([a])	--------
Communication equipment and electronic components	366–67, 48	62,700	900	1,000	4,700	([a])	([a])
Other electrical equipment	361–64, 369	36,000	1,200	([a])	([a])	([a])	([a])
Motor vehicles and other transportation equipment	371, 373–75, 379	23,900	200	200	1,900	1,700	19,900
Aircraft and missiles	372, 19	93,900	400	100	2,100	7,100	84,300
Professional and scientific instruments	38	13,400	800	800	4,500	([a])	([a])
Scientific and mechanical measuring instruments	381–82	3,300	400	500	([a])	([a])	--------
Optical, surgical, photographic, and other instruments	383–87	10,100	400	300	([a])	([a])	([a])
Other manufacturing industries	21, 27, 31, 39	2,700	300	300	([a])	([a])	--------
Nonmanufacturing industries	07–12, 14–17, 41–47, 49–67, 739, 807, 891	14,500	1,700	1,500	5,900	5,400	--------

[a] Not separately available but included in total.

[b] Estimated. See table 5, footnote b.

TABLE B-16.—*Full-time-equivalent number of R&D scientists and engineers, by industry and source of funds for R&D projects, January 1969 and January 1970*

Industry	SIC code	January 1969			January 1970		
		Total	Federal	Company	Total	Federal	Company
Total		387,100	157,700	229,500	380,600	148,100	232,500
Food and kindred products	20	5,700	(a)	5,600	6,000	(a)	6,000
Textiles and apparel	22, 23	2,600	(b)	(b)	2,600	(b)	(b)
Lumber, wood products, and furniture	24, 25	1,100	(a)	1,100	1,100	(a)	1,100
Paper and allied products	26	2,700	(b)	(b)	2,900	(b)	(b)
Chemicals and allied products	28	42,200	3,800	38,400	42,000	3,300	38,700
Industrial chemicals	281–82	23,600	3,000	20,600	23,000	2,700	20,300
Drugs and medicines	283	10,300	(b)	(b)	11,000	(b)	(b)
Other chemicals	284–89	8,300	(b)	(b)	8,000	(b)	(b)
Petroleum refining and extraction	29, 13	11,900	1,500	10,400	11,800	1,200	10,600
Rubber products	30	6,300	900	5,400	6,400	900	5,600
Stone, clay, and glass products	32	5,500	100	5,400	5,700	100	5,600
Primary metals	33	6,200	200	6,000	6,500	200	6,300
Ferrous metals and products	331–32, 3391, 3399	3,200	(a)	3,200	3,300	(a)	3,300
Nonferrous metals and products	333–36, 3392	3,000	200	2,800	3,200	200	3,000
Fabricated metal products	34	6,600	600	6,100	6,000	300	5,700
Machinery	35	42,800	9,900	33,000	44,100	8,500	35,600
Electrical equipment and communication	36, 48	100,500	52,800	47,700	101,200	51,000	50,100
Radio and TV receiving equipment	365	2,100	(b)	(b)	2,100	(b)	(b)
Communication equipment and electronic components	366–67, 48	62,400	34,800	27,700	63,100	34,100	29,000
Other electrical equipment	361–64, 369	36,100	(b)	(b)	36,000	(b)	(b)
Motor vehicles and other transportation equipment	371, 373–75, 379	24,700	6,100	18,600	23,700	5,000	18,700
Aircraft and missiles	372, 19	97,600	70,700	26,800	90,000	66,600	23,300
Professional and scientific instruments	38	13,400	3,600	9,900	13,300	3,300	10,100
Scientific and mechanical measuring instruments	381–82	3,400	800	2,700	3,300	700	2,600
Optical, surgical, photographic, and other instruments	383–87	10,000	2,800	7,200	10,100	2,500	7,500
Other manufacturing industries	21, 27, 31, 39	2,800	(b)	(b)	2,700	(b)	(b)
Nonmanufacturing industries	07–12, 14–17, 41–47, 49–67, 739, 807, 891	14,500	7,500	7,000	14,600	7,600	7,000

---

[a] Less than 50.

[b] Not separately available but included in total.

Table B–17.—*Federal funds for R&D performance, by selected industry and agency, 1969*

[Dollars in millions]

Industry	SIC code	Total	Federal			
			Total	DOD	NASA	All other agencies
Total		$18,474	$8,619	$5,798	$1,904	$916
Chemicals and allied products	28	1,752	192	49	5	138
Machinery	35	1,746	390	259	108	22
Electrical equipment and communication	36, 48	4,294	2,329	1,559	331	439
Motor vehicles and other transportation equipment	371, 373–79	1,647	406	349	47	10
Aircraft and missiles	372, 19	5,801	4,524	3,061	1,288	174
Other industries		3,234	778	521	125	133

Table B–18.—*R&D scientists and engineers—man-years and cost, by source of funds and Federal agency, 1969*

Industry	SIC code	Total	Company	Federal			
				Total	DOD	NASA	All other agencies
		Man-years of R&D scientists and engineers					
Total		383,200	230,100	153,100	103,800	33,200	16,200
Chemicals and allied products	28	42,000	38,500	3,500	1,100	(a)	2,300
Machinery	35	43,400	34,200	9,100	5,800	2,700	700
Electrical equipment and communication	36, 48	100,800	48,900	51,900	35,100	9,100	7,600
Motor vehicles and other transportation equipment	371, 373–79	23,900	18,500	5,400	4,100	(a)	(a)
Aircraft and missiles	372, 19	93,900	4,800	69,100	48,600	17,500	3,100
Other industries		79,200	65,200	14,100	9,100	2,600	2,400
		Cost per R&D scientist or engineer					
Total		$48,200	$42,800	$56,300	$55,900	$57,400	$56,700
Chemicals and allied products	28	41,700	40,600	54,200	44,400	(a)	59,900
Machinery	35	40,300	39,600	42,600	45,000	39,900	33,700
Electrical equipment and communication	36, 48	42,600	40,200	44,900	44,400	36,400	57,500
Motor vehicles and other transportation equipment	371, 373–79	68,900	67,200	74,600	84,300	(a)	(a)
Aircraft and missiles	372, 19	61,800	51,400	65,500	63,100	73,700	57,000
Other industries		40,800	37,700	55,200	57,300	48,100	55,400

---

[a] Not separately available but included in total.

TABLE B-19.—*Number of R&D scientists and engineers per 1,000 employees, by industry and size of company, 1958–69*[a]

Industry and size of company	SIC code	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
Total		21	24	25	28	28	28	30	30	27	27	26	26
Distribution by industry													
Food and kindred products	20	6	7	7	6	7	7	7	7	7	7	7	7
Textiles and apparel	22, 23	1	2	2	3	([b])	3	3	3	3	3	4	4
Lumber, wood products, and furniture	24, 25	5	8	7	4	6	4	5	5	4	4	4	5
Paper and allied products	26	6	6	6	6	6	6	6	6	6	6	6	6
Chemicals and allied products	28	39	40	46	40	38	40	41	39	38	36	36	36
Industrial chemicals	281–82	42	42	46	43	38	40	40	38	35	33	33	32
Drugs and medicines	283	46	42	50	42	44	47	54	53	53	51	51	50
Other chemicals	284–89	30	34	41	32	33	38	33	32	35	33	33	34
Petroleum refining and extraction	29, 13	15	14	18	19	18	17	16	17	17	18	18	19
Rubber products	30	19	18	19	20	20	20	19	18	17	17	17	17
Stone, clay, and glass products	32	([b])	([c])	([c])	12	12	12	12	12	13	14	14	13
Primary metals	33	5	5	6	7	6	5	5	5	5	5	5	6
Ferrous metals and products[d]	331–32, 3391, 3399	4	4	4	5	4	4	4	4	4	4	4	4
Nonferrous metals and products	333–36, 3392	6	7	10	11	11	8	8	8	8	8	8	9
Fabricated metal products	34	16	17	13	17	16	15	16	15	13	14	11	12
Machinery	35	22	24	28	28	26	28	28	27	27	28	27	28
Electrical equipment and communication	36, 48	43	42	51	54	54	55	55	53	44	43	45	44
Radio and TV receiving equipment	365	([e])	([e])	([e])	([e])	([e])	([e])	([e])	([e])	([e])	18	22	22
Communication equipment and electronic components	366–67, 48	52	47	62	66	67	67	69	66	53	52	51	51
Other electrical equipment	361–64, 369	37	38	41	42	40	41	40	39	38	35	40	38
Motor vehicles and other transportation equipment	371, 373–75 ,379	16	16	14	20	20	19	20	20	20	20	19	18
Aircraft and missiles	372, 19	72	73	85	91	87	99	110	113	95	89	80	78
Professional and scientific instruments	38	44	47	31	39	36	36	37	36	33	32	34	32
Scientific and mechanical measuring instruments	381–82	57	64	46	45	43	38	35	33	28	26	27	24
Optical, surgical, photographic, and other instruments	383–87	33	34	23	34	31	35	38	39	36	35	37	36
Other manufacturing industries	21, 27, 31, 39	([b])	10	8	9	8	9	8	8	7	6	6	8
Nonmanufacturing industries	07–12, 14–17, 41–47, 49–67, 739, 807, 891				8	8	9	11	10	12	13	12	12
Distribution by size of company (based on number of employees)													
Less than 1,000		18	24	23	26	27	27	27	27	28	28	28	([b])
1,000 to 4,999		12	14	16	18	19	19	19	18	16	16	16	([b])
5,000 to 9,999		25	20	28	30	30	31	32	31	30	15	16	17
10,000 or more											31	30	29

---

[a] The full-time-equivalent number of R&D scientists and engineers per 1,000 employees in 1966 was derived by dividing the arithmetic mean of the full-time-equivalent number of R&D scientists and engineers employed in January 1966 and January 1967 by the number of company employees in all activities (in thousands), March 1966. Similar procedures were used to compute ratios for 1958–65. For 1967 to present, data were derived by dividing man-years of R&D scientists and engineers for the year by March employment figures.

[b] Not separately available but included in total.

[c] Data included in the other manufacturing industries group.

[d] SIC codes 3391 and 3399 included in the nonferrous metals and products group for 1958 to 1966.

[e] Included in the other electrical equipment group for 1958 to 1966.

TABLE B-20.—*R&D-performing companies in manufacturing and nonmanufacturing industries, by size of company, 1969*

Size of company (based on number of employees)	Number of companies		
	Total	Manufacturing industries	Nonmanufacturing industries
Total	11,317	([a])	([a])
Less than 1,000	[b] 10,000	([a])	([a])
1,000 to 4,999	[c] 802	685	117
5,000 to 9,999	209	188	21
10,000 or more	306	283	23

[a] Not separately available but included in total.

[b] This estimate represents the midpoint of a range from 6,000 to 14,000.

[c] 40 percent of this number is represented by companies that reported less than $200,000 in R&D expenditures in 1968. See table 5, footnote b.

TABLE B-21.—*R&D-performing companies with 1,000 or more employees,[a] by size of company and R&D program, 1969*

Distribution by size of company (based on number of employees)	Total	Size of R&D program (thousands of dollars)				
		Less than $200	$200 to $999	$1,000–$9,999	$10,000–$99,999	$100,000 or more
Total	1,317	[b] 353	304	479	151	30
1,000 to 4,999	802	318	241	229	14	----------
5,000 to 9,999	209	22	44	118	25	----------
10,000 or more	306	13	19	132	112	30

[a] Data not available for companies with less than 1,000 employees.

[b] Estimated. See table 5, footnote b.

TABLE B-22.—*Percent of total, Federal, and company funds of all R&D-performing manufacturing companies accounted for by the companies with the largest R&D programs, 1959–69*

Companies ranked by size of R&D program (based on total R&D funds)[a]	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
	Percent of total R&D funds										
First 4	22	22	22	22	21	22	21	22	22	21	19
First 8	33	34	34	35	35	35	35	36	35	35	34
First 20	54	54	54	55	56	57	57	57	57	57	56
First 40	68	68	69	69	70	70	70	71	70	70	68
First 100	81	81	81	80	82	82	82	82	82	82	80
First 200	88	88	88	87	88	89	89	89	89	89	88
First 300	91	92	91	91	91	92	92	92	92	92	91
	Percent of Federal R&D funds										
First 4	29	28	32	29	28	27	28	31	34	33	25
First 8	41	42	45	46	46	47	47	45	43	43	42
First 20	68	65	66	68	71	71	73	73	73	73	71
First 40	86	83	84	84	86	87	86	89	88	88	84
First 100	94	92	92	93	95	95	95	95	95	96	93
First 200	98	96	96	96	97	97	97	98	98	98	96
First 300	99	97	97	97	98	99	99	99	99	99	97
	Percent of company R&D funds										
First 4	13	13	9	12	12	15	14	12	9	9	13
First 8	22	23	20	20	20	19	21	26	27	28	27
First 20	33	36	38	38	37	38	38	39	41	43	43
First 40	43	48	50	49	48	49	51	50	52	53	53
First 100	62	65	66	64	64	65	67	67	68	70	69
First 200	73	76	78	76	76	77	78	79	79	81	80
First 300	79	83	84	82	82	83	84	85	85	87	86

[a] Companies were ranked individually for each year. Therefore, particular companies comprising the size groups may have changed from year to year.

TABLE B-23.—*Percent of net sales and employment of all R&D-performing manufacturing companies accounted for by the companies with the largest R&D programs, 1959–69*

Companies ranked by size of R&D program (based on total R&D funds)[a]	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
	Percent of net sales										
First 4	7	7	6	7	8	8	8	8	4	4	7
First 8	10	10	10	10	10	10	11	11	11	11	10
First 20	18	17	17	17	18	18	19	19	19	21	18
First 40	24	24	24	24	25	25	27	25	28	27	25
First 100	41	40	40	38	41	41	43	45	42	44	39
First 200	53	52	52	49	54	54	55	58	55	59	53
First 300	61	59	60	60	62	63	65	68	67	68	63
	Percent of employment										
First 4	8	8	7	8	8	9	9	9	5	5	8
First 8	10	12	11	11	12	12	13	13	12	12	12
First 20	20	20	19	20	20	21	21	21	21	22	20
First 40	26	26	26	26	27	28	28	28	29	29	27
First 100	40	40	40	38	41	41	42	43	43	43	39
First 200	52	50	50	47	52	54	54	54	54	56	51
First 300	60	58	57	59	60	62	63	63	64	65	62

[a] Companies were ranked individually for each year. Therefore, particular companies comprising the size groups may have changed from year to year.

TABLE B-24.—*Percent of total and Federal R&D performance funds and percent of net sales of all R&D-performing companies accounted for by the companies with the largest R&D programs, by industry, 1969*

Industry	SIC code	Percent of total R&D funds			Percent of Federal R&D funds			Percent of net sales of all R&D-performing companies		
		First 4 companies	First 8 companies	First 20 companies	First 4 companies	First 8 companies	First 20 companies	First 4 companies	First 8 companies	First 20 companies
Total	----------	19	34	56	25	42	71	7	10	18
Food and kindred products	20	28	45	73	50	54	93	14	27	51
Textiles and apparel	22, 23	37	55	74	86	86	100	35	45	57
Lumber, wood products, and furniture	24, 25	29	46	58	----------	----------	----------	36	48	71
Paper and allied products	26	35	58	84	----------	----------	----------	26	51	75
Chemicals and allied products	28	36	47	68	71	85	95	22	30	50
Industrial chemicals	281-82	59	75	91	80	98	100	38	52	83
Drugs and medicines	283	40	60	89	13	43	60	20	48	86
Other chemicals	284-89	44	59	79	100	100	100	37	49	71
Petroleum refining and extraction	29, 13	56	76	97	92	93	100	33	64	92
Rubber products	30	69	85	92	37	81	83	65	75	88
Stone, clay, and glass products	32	65	80	89	80	100	100	39	54	77
Primary metals	33	38	54	79	73	75	83	33	47	68
Ferrous metals and products	331-32, 3391, 3399	60	76	93	77	94	94	51	64	86
Nonferrous metals and products	333-36, 3392	48	69	89	75	76	99	41	52	75
Fabricated metal products	34	39	57	70	30	95	97	32	44	56
Machinery	35	57	70	82	82	94	98	21	31	48
Electrical equipment and communication	36, 48	55	70	85	56	76	94	36	50	64
Radio and TV receiving equipment	365	92	96	([a])	100	100	([a])	74	93	([a])
Communication equipment and electronic components	366-67, 48	58	76	92	59	77	94	49	64	82
Other electrical equipment	361-64, 369	83	88	93	98	99	100	53	56	74
Motor vehicles and other transportation equipment	371, 373-75, 379	92	96	99	94	97	100	80	85	94
Aircraft and missiles	372, 19	54	83	98	53	83	99	35	55	92
Professional and scientific instruments	38	69	78	88	87	88	93	34	49	71
Scientific and mechanical measuring instruments	381-82	32	51	75	39	59	96	33	51	71
Optical, surgical, photographic, and other instruments	383-87	79	89	96	94	95	99	48	69	88
Other manufacturing industries	21, 27, 31, 39	38	54	78	----------	----------	76	31	52	73
Nonmanufacturing industries	07-12, 14-17, 41-47, 49-67, 739, 807, 891	29	44	60	42	56	75	1	1	18

[a] Less than 20 companies.

TABLE B-25.—*R&D-performing companies with 1,000 or more employees*[a] *and number with Federal funds for R&D performance, by industry and size of company, 1969*

Industry	SIC code	Companies with total employment of—											
		1,000 or more			1,000 to 4,999			5,000 to 9,999			10,000 or more		
		Total	Federal	Percent of total	Total	Federal	Percent of total	Total	Federal	Percent of total	Total	Federal	Percent of total
Total	--------	1,317	279	21	[b] 802	80	10	209	55	27	306	144	47
Food and kindred products	20	101	7	7	58	2	3	16	1	6	27	4	15
Textiles and apparel	22, 23	70	3	4	47	1	2	7	--------	--------	16	2	13
Lumber, wood products, and furniture	24, 25	28	--------	--------	19	--------	--------	5	--------	--------	4	--------	--------
Paper and allied products	26	50	4	8	25	1	4	9	--------	--------	16	3	19
Chemicals and allied products	28	107	29	27	54	--------	--------	21	7	33	32	22	69
Industrial chemicals	281-82	42	17	40	17	--------	--------	3	1	33	22	16	73
Drugs and medicines	283	27	10	37	12	--------	--------	9	6	67	6	4	67
Other chemicals	284-89	38	2	5	25	--------	--------	9	--------	--------	4	2	50
Petroleum refining and extraction	29, 13	35	12	34	11	--------	--------	6	--------	--------	18	12	67
Rubber products	30	33	6	18	21	--------	--------	6	2	33	6	4	67
Stone, clay, and glass products	32	46	7	15	28	--------	--------	8	1	13	10	6	60
Primary metals	33	81	14	17	44	5	11	15	3	20	22	6	27
Ferrous metals and products	331-32, 3391, 3399	45	4	9	22	--------	--------	10	2	20	13	2	15
Nonferrous metals and products	333-36, 3392	36	10	28	22	5	23	5	1	20	9	4	44
Fabricated metal products	34	73	13	18	53	2	4	11	3	27	9	8	89
Machinery	35	171	29	17	114	8	7	24	8	35	33	13	39
Electrical equipment and communication	36, 48	151	59	39	92	18	20	24	13	54	35	28	80
Radio and TV receiving equipment	365	7	3	43	3	--------	--------	--------	--------	--------	4	3	75
Communication equipment and electronic components	366-67, 48	67	39	58	37	12	33	12	10	83	18	17	94
Other electrical equipment	361-64, 369	77	17	22	52	6	11	12	3	25	13	8	62
Motor vehicles and other transportation equipment	371, 373-75, 379	48	15	31	23	4	17	8	3	38	17	8	47
Aircraft and missiles	372, 19	45	32	71	20	9	44	4	4	100	21	19	90
Professional and scientific instruments	38	54	24	45	32	7	22	13	9	69	9	8	89
Scientific and mechanical measuring instruments	381-82	24	8	33	17	3	18	5	3	60	2	2	100
Optical, surgical, photographic, and other instruments	383-87	30	16	54	15	4	27	8	6	75	7	6	86
Other manufacturing industries	21, 27, 31, 39	63	3	5	44	3	7	11	--------	--------	8	--------	--------
Nonmanufacturing industries	07-12, 14-17, 41-47, 49-67, 739, 807, 891	161	22	14	117	20	17	21	1	5	23	1	4

---

[a] Data not available for companies with less than 1,000 employees.

[b] See table 20, footnote c.

TABLE B-26.—*Distribution of R&D costs, by industry and type of cost, 1969*

Industry	SIC code	Coverage ratio [a]	Millions of dollars					Percent distribution				
				Wages					Wages			
			R&D costs	Scientists and engineers	R&D supporting personnel	Materials and supplies	Other R&D costs	R&D costs	Scientists and engineers	R&D supporting personnel	Materials and supplies	Other R&D costs
Total		76	$18,474	$5,462	$3,642	$3,376	$5,995	100	30	20	18	32
Food and kindred products	20	72	185	71	40	31	43	100	38	22	17	23
Textiles and apparel	22, 23	52	60	24	13	9	14	100	40	22	14	24
Lumber, wood products, and furniture	24, 25	48	24	10	4	5	5	100	42	17	19	22
Paper and allied products	26	83	113	41	22	18	32	100	36	20	16	29
Chemicals and allied products	28	69	1,752	629	370	254	499	100	36	21	15	29
Industrial chemicals	281-82	61	1,065	353	242	173	297	100	33	23	16	28
Drugs and medicines	283	79	437	178	74	48	138	100	41	17	11	31
Other chemicals	284-89	83	250	98	53	33	65	100	39	21	13	26
Petroleum refining and extraction	29, 13	81	572	199	101	60	212	100	35	18	11	37
Rubber products	30	83	240	79	47	28	86	100	33	19	12	36
Stone, clay, and glass products	32	44	191	71	42	31	47	100	37	22	16	25
Primary metals	33	57	267	88	66	49	65	100	33	25	18	24
Ferrous metals and products	331-32, 3391, 3399	37	142	47	34	32	30	100	33	24	22	21
Nonferrous metals and products	333-36, 3392	80	125	41	32	18	35	100	33	25	14	28
Fabricated metal products	34	79	183	70	41	30	44	100	38	22	16	24
Machinery	35	89	1,746	571	375	284	516	100	33	22	16	30
Electrical equipment and communication	36, 48	74	4,294	1,270	796	880	1,348	100	30	19	21	31
Radio and TV receiving equipment	365	53	109	31	25	16	38	100	28	23	14	35
Communication equipment and electronic components	366-67, 48	77	2,454	740	411	545	759	100	30	17	22	31
Other electrical equipment	361-64, 369	71	1,731	500	360	320	551	100	29	21	19	32
Motor vehicles and other transportation equipment	371, 373-75, 379	97	1,647	385	531	289	443	100	23	32	18	27
Aircraft and missiles	372, 19	77	5,801	1,480	899	1,177	2,245	100	26	16	20	39
Professional and scientific instruments	38	45	664	240	163	112	149	100	36	25	17	22
Scientific and mechanical measuring instruments	381-82	68	88	37	20	11	20	100	43	22	13	22
Optical, surgical, photographic, and other instruments	383-87	41	576	203	143	101	129	100	35	25	18	22
Other manufacturing industries	21, 27, 31, 39	91	96	35	23	13	25	100	37	24	13	26
Nonmanufacturing industries	07-12, 14-17, 41-47, 49-67, 739, 807, 891	67	640	200	110	107	224	100	31	17	17	35

---

[a] The coverage ratio is derived by dividing R&D funds for which a distribution by type of cost was reported by total R&D funds, including those for which a distribution by type of cost was not reported.

TABLE B–27.—*Distribution of R&D costs, by industry and type of cost, 1968*

Industry	SIC code	Coverage ratio [a]	Millions of dollars					Percent distribution				
				Wages					Wages			
			R&D costs	Scientists and engineers	R&D supporting personnel	Materials and supplies	Other R&D costs	R&D costs	Scientists and engineers	R&D supporting personnel	Materials and supplies	Other R&D costs
Total		75	$17,469	$5,224	$3,425	$3,150	$5,669	100	30	20	18	33
Food and kindred products	20	69	167	65	35	27	40	100	39	21	16	24
Textiles and apparel	22, 23	51	58	22	13	9	14	100	38	23	16	23
Lumber, wood products, and furniture	24, 25	44	22	10	4	4	4	100	45	18	17	20
Paper and allied products	26	83	93	35	19	15	25	100	38	20	16	26
Chemicals and allied products	28	69	1,658	589	355	249	465	100	36	21	15	28
Industrial chemicals	281–82	62	1,027	340	239	172	276	100	33	23	17	27
Drugs and medicines	283	78	394	159	65	43	127	100	40	17	11	32
Other chemicals	284–89	82	238	90	51	33	63	100	38	22	14	27
Petroleum refining and extraction	29, 13	80	539	185	100	63	191	100	34	19	12	35
Rubber products	30	84	230	78	42	25	86	100	34	18	11	37
Stone, clay, and glass products	32	48	164	60	38	24	43	100	36	23	14	26
Primary metals	33	56	251	81	62	46	61	100	32	25	18	25
Ferrous metals and products	331–32, 3391, 3399	37	135	43	32	29	30	100	32	24	22	22
Nonferrous metals and products	333–36, 3392	78	116	38	30	17	31	100	33	26	15	27
Fabricated metal products	34	79	183	72	38	32	42	100	39	21	17	23
Machinery	35	88	1,614	528	338	270	477	100	33	21	17	30
Electrical equipment and communication	36, 48	75	4,049	1,194	749	912	1,194	100	30	19	23	30
Radio and TV receiving equipment	365	51	101	30	21	17	34	100	30	20	16	33
Communication equipment and electronic components	366–67, 48	77	2,321	717	388	553	663	100	31	17	24	29
Other electrical equipment	361–64, 369	73	1,627	446	341	342	497	100	27	21	21	31
Motor vehicles and other transportation equipment	371, 373–75, 379	97	1,518	368	455	258	437	100	24	30	17	29
Aircraft and missiles	372, 19	74	5,658	1,492	929	1,019	2,219	100	26	16	18	39
Professional and scientific instruments	38	42	600	229	131	95	145	100	38	22	16	24
Scientific and mechanical measuring instruments	381–82	72	87	37	19	11	20	100	43	22	12	23
Optical, surgical, photographic, and other instruments	383–87	37	513	192	111	85	125	100	37	22	17	24
Other manufacturing industries	21, 27, 31, 39	91	89	33	22	12	22	100	37	25	13	25
Nonmanufacturing industries	07–12, 14–17, 41–47, 49–67, 739, 807, 891	68	575	185	94	91	205	100	32	16	16	36

---

[a] The coverage ratio is derived by dividing R&D funds for which a distribution by type of cost was reported by total R&D funds, including those for which a distribution by type of cost was not reported.

TABLE B-28.—*Funds for basic research, applied research, and development performance, 1953–69*

[Dollars in millions]

Year	Total	Basic research	Applied research	Development
1953	$3,630	$151	[a] $726	[a] $2753
1954	4,070	166	[a] 814	[a] 3,090
1955	4,640	189	[a] 928	[a] 3,523
1956	6,605	253	1,268	5,084
1957	7,731	271	1,670	5,790
1958	8,389	295	1,911	6,183
1959	9,618	320	1,991	7,307
1960	10,509	376	2,029	8,104
1961	10,908	395	1,977	8,537
1962	11,464	488	2,449	8,527
1963	12,630	522	2,457	9,651
1964	13,512	549	2,600	10,362
1965	14,185	592	2,658	10,934
1966	15,548	624	2,843	12,081
1967	16,415	629	2,915	12,872
1968	17,469	642	3,124	13,703
1969	18,474	646	3,315	14,513

[a] Estimated by the National Science Foundation.

TABLE B–29.—*Funds for basic research, applied research, and development performance, by industry and selected company size groups, 1968 and 1969*

[Dollars in millions]

Industry and size of company	SIC code	1968				1969			
		Total	Basic research	Applied research	Development	Total	Basic research	Applied research	Development
Total		$17,469	$642	$3,124	$13,703	$18,474	$646	$3,315	$14,513
Distribution by industry									
Food and kindred products	20	167	10	74	83	185	11	84	90
Textiles and apparel	22, 23	58	2	21	36	60	2	20	38
Lumber, wood products, and furniture	24, 25	22	(a)	(a)	(a)	24	(a)	(a)	(a)
Paper and allied products	26	93	3	34	56	113	3	38	71
Chemicals and allied products	28	1,658	214	603	841	1,752	223	666	863
Industrial chemicals	281–82	1,027	(a)	(a)	(a)	1,065	(a)	(a)	(a)
Drugs and medicines	283	394	64	144	186	437	73	159	205
Other chemicals	284–89	238	16	74	148	250	14	84	152
Petroleum refining and extraction	29, 13	539	38	219	282	572	39	212	321
Rubber products	30	230	6	58	167	240	5	61	174
Stone, clay, and glass products	32	164	(a)	(a)	(a)	191	(a)	(a)	(a)
Primary metals	33	251	14	86	150	267	15	96	156
Ferrous metals and products	331–32, 3391, 3399	135	(a)	(a)	(a)	142	(a)	(a)	(a)
Nonferrous metals and products	333–36, 3392	115	5	51	59	125	7	58	60
Fabricated metal products	34	183	3	44	136	183	3	41	140
Machinery	35	1,614	32	212	1,370	1,746	20	255	1,471
Electrical equipment and communication	36, 48	4,049	136	598	3,315	4,294	137	667	3,490
Radio and TV receiving equipment	365	101	(a)	(a)	(a)	109	(a)	(a)	(a)
Communication equipment and electronic components	366–67, 48	2,321	114	343	1,864	2,454	119	388	1,947
Other electrical equipment	361–64, 369	1,627	(a)	(a)	(a)	1,731	(a)	(a)	(a)
Motor vehicles and other transportation equipment	371, 373–75, 379	1,518	(a)	(a)	(a)	1,647	(a)	(a)	(a)
Aircraft and missiles	372, 19	5,658	67	664	4,928	5,801	63	589	5,149
Professional and scientific instruments	38	600	(a)	(a)	(a)	664	(a)	(a)	(a)
Other manufacturing industries	21, 27, 31, 39	89	5	23	61	96	5	23	68
Nonmanufacturing industries	07–12, 14–17, 41–47, 49–67, 739, 807, 891	575	41	224	310	640	49	258	333
Distribution by size of company (based on number of employees)									
5,000 to 9,999		960	55	228	677	1,048	62	254	732
10,000 or more		14,820	490	2,380	11,950	15,660	482	2,511	12,667

[a] Not separately available but included in total.

TABLE B-30.—*Funds for basic research, applied research, and development performance, by industry, source, and selected company size groups, 1969*

[Dollars in millions]

Industry and size of company	SIC code	Federal				Company			
		Total	Basic research	Applied research	Development	Total	Basic research	Applied research	Development
Total	--------	$8,619	$164	$1,047	$7,407	$9,856	$481	$2,268	$7,106
Distribution by industry									
Food and kindred products	20	2	--------	--------	1	183	11	84	89
Textiles and apparel	22, 23	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
Lumber, wood products, and furniture	24, 25	--------	--------	--------	--------	24	(a)	(a)	(a)
Paper and allied products	26	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
Chemicals and allied products	28	192	41	47	104	1,560	182	619	760
Petroleum refining and extraction	29, 13	47	3	9	35	524	37	203	285
Rubber products	30	43	--------	9	34	196	5	52	139
Stone, clay, and glass products	32	4	(a)	(a)	(a)	187	(a)	(a)	(a)
Primary metals	33	10	--------	6	4	257	15	89	152
Ferrous metals and products	331-32, 3391, 3399	1	--------	--------	(a)	141	(a)	(a)	(a)
Nonferrous metals and products	333-36, 3392	9	--------	6	3	116	7	52	57
Fabricated metal products	34	11	--------	2	9	172	3	39	131
Machinery	35	390	--------	73	317	1,356	20	182	1,154
Electrical equipment and communication	36, 48	2,329	41	334	1,955	1,965	96	333	1,536
Radio and TV receiving equipment	365	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
Communication equipment and electronic components	366-67, 48	1,390	35	197	1,158	1,064	84	191	789
Other electrical equipment	361-64, 369	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
Motor vehicles and other transportation equipment	371, 373-75, 379	406	(a)	(a)	(a)	1,241	(a)	(a)	(a)
Aircraft and missiles	372, 19	4,524	24	342	4,158	1,277	40	247	990
Professional and scientific instruments	38	215	(a)	(a)	(a)	448	(a)	(a)	(a)
Scientific and mechanical measuring instruments	381-82	15	2	(a)	(a)	72	(a)	(a)	(a)
Optical, surgical, photographic, and other instruments	383-87	200	(a)	(a)	(a)	376	(a)	(a)	(a)
Other manufacturing industries	21, 27, 31, 39	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
Nonmanufacturing industries	07-12, 14-17, 41-47, 49-67, 739, 807, 891	440	40	175	225	200	9	83	108
Distribution by size of company (based on number of employees)									
5,000 to 9,999	--------	315	5	64	245	734	57	190	487
10,000 or more	--------	7,714	104	764	6,846	7,947	379	1,747	5,821

[a] Not separately available but included in total.

TABLE B–31.—*Funds for basic research performance, by industry and size of company, 1957–69*

[Dollars in millions]

Industry and size of company	SIC code	1957 [a]	1958 [a]	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
Total		$271	$295	$320	$376	$395	$488	$522	$549	$592	$624	$629	$642	$646
Distribution by industry														
Food and kindred products	20	4	5	7	7	9	(b)	12	13	8	9	11	10	11
Textiles and apparel	22, 23	1	1	(b)	(b)	(b)	(b)	1	(b)	(b)	1	2	2	2
Lumber, wood products, and furniture	24, 25								(b)	(b)			(b)	(b)
Paper and allied products	26	1	(b)	(b)	(b)	1	1	2	2	3	3	3	3	3
Chemicals and allied products	28	82	92	105	115	124	136	152	155	179	186	195	214	223
Industrial chemicals	281–82	(b)	(b)	71	77	82	91	105	106	123	(b)	(b)	(b)	(b)
Drugs and medicines	283	18	21	26	28	29	31	33	36	40	49	52	64	73
Other chemicals	284–89	6	6	(b)	10	(b)	(b)	14	(b)	(b)	9	14	16	14
Petroleum refining and extraction	29, 13	35	34	39	32	34	35	34	37	35	30	31	38	39
Rubber products	30	4	(b)	3	6	10	10	8	(b)	(b)	5	5	6	5
Stone, clay, and glass products	32	(c)	(c)	(c)	6	5	6	6	5	8	(b)	(b)	(b)	(b)
Primary metals	33	6	7	8	10	11	10	11	11	13	12	13	14	15
Ferrous metals and products [d]	331–32, 3391, 3399	5	5	5	8	7	7	8	8	10	(b)	(b)	(b)	(b)
Nonferrous metals and products	333–36, 3392	(b)	2	(b)	3	4	2	3	3	3	3	4	5	7
Fabricated metal products	34	1	1	1	2	(b)	4	5	4	4	4	3	3	3
Machinery	35	17	20	19	22	25	27	25	26	24	28	29	32	20
Electrical equipment and communication	36, 48	53	63	66	77	79	125	133	134	147	121	131	136	137
Radio and TV receiving equipment	365	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(b)	(b)	(b)	(b)
Communication equipment and electronic components	366–67, 48	36	43	45	57	59	95	110	112	121	96	111	114	119
Other electrical equipment	361–64, 369	17	21	21	20	20	30	23	22	26	(b)	(b)	(b)	(b)
Motor vehicles and other transportation equipment	371, 373–75, 379	5	(b)	7	9	18	24	28	38	37	(b)	(b)	(b)	(b)
Aircraft and missiles	372, 19	25	26	32	62	40	55	59	67	70	68	70	67	63
Professional and scientific instruments	38	8	10	9	9	(b)	(b)	(b)	(b)	(b)	(b)	(b)	(b)	(b)
Scientific and mechanical measuring instruments	381–82	3	2	2	3	3	4	4	3	3	(b)	(b)	(b)	(b)
Optical, surgical, photographic, and other instruments	383–87	6	8	(b)	(b)	(b)	(b)	(b)	(b)	(b)	(b)	(b)	(b)	(b)
Other manufacturing industries	21, 27, 31, 39	13	8	8	4	4	4	3	4	4	4	5	5	5
Nonmanufacturing industries	07–12, 14–17, 41–47, 49–67, 739, 807, 891	(b)	(b)	(b)	(b)	(b)	(b)	28	25	29	50	49	41	49
Distribution by size of company (based on number of employees)														
Less than 1,000		(b)	(b)	(b)	(b)	(b)	(b)	(b)	(b)	(b)	39	56	(b)	(b)
1,000 to 4,999		24	32	39	34	31	34	31	34	40	67	45	(b)	(b)
5,000 to 9,999		218	240	261	320	326	403	439	461	488	38	50	55	62
10,000 or more											480	478	490	482

---

[a] Estimated by the National Science Foundation.

[b] Not separately available but included in total.

[c] Data included in the other manufacturing industries group.

[d] SIC codes 3391 and 3399 included in the nonferrous metals and products group for 1957 to 1965.

[e] Included in the other electrical equipment group.

TABLE B–32.—*Funds for basic research performance, by industry and selected company size groups, 1968 and 1969*

[Dollars in millions]

Industry	SIC code	1968 Total	1968 Companies with total employment of— 5,000 to 9,999	1968 Companies with total employment of— 10,000 or more	1969 Total	1969 Companies with total employment of— 5,000 to 9,999	1969 Companies with total employment of— 10,000 or more
Total		$642	$55	$490	$646	$62	$482
Food and kindred products	20	10	--------	9	11	--------	9
Textiles and apparel	22, 23	2	(a)	(a)	2	(a)	(a)
Lumber, wood products, and furniture	24, 25	(a)	(a)	(a)	(a)	(a)	(a)
Paper and allied products	26	3	(a)	2	3	(a)	2
Chemicals and allied products	28	214	36	157	223	43	159
Industrial chemicals	281–82	(a)	(a)	(a)	(a)	(a)	(a)
Drugs and medicines	283	64	(a)	23	73	(a)	26
Other chemicals	284–89	16	6	(a)	14	7	(a)
Petroleum refining and extraction	29, 13	38	1	37	39	1	38
Rubber products	30	6	(a)	5	5	(a)	4
Stone, clay, and glass products	32	(a)	(a)	(a)	(a)	(a)	(a)
Primary metals	33	14	(a)	12	15	(a)	13
Ferrous metals and products	331–32, 3391, 3399	(a)	(a)	(a)	(a)	(a)	(a)
Nonferrous metals and products	333–36, 3392	5	(a)	4	7	(a)	5
Fabricated metal products	34	3	(a)	(a)	3	(a)	(a)
Machinery	35	32	1	29	20	1	17
Electrical equipment and communication	36, 48	136	6	112	137	7	118
Radio and TV receiving equipment	365	(a)	--------	(a)	(a)	--------	(a)
Communication equipment and electronic components	366–67, 48	114	(a)	(a)	119	(a)	(a)
Other electrical equipment	361–64, 369	(a)	(a)	(a)	(a)	(a)	(a)
Motor vehicles and other transportation equipment	371, 373–75, 379	(a)	--------	(a)	(a)	--------	(a)
Aircraft and missiles	372, 19	67	(a)	64	63	(a)	60
Professional and scientific instruments	38	(a)	(a)	(a)	(a)	(a)	(a)
Other manufacturing industries	21, 27, 31, 39	5	1	3	5	1	3
Nonmanufacturing industries	07–12, 14–17, 41–47, 49–67, 739, 807, 891	41	--------	1	49	--------	1

---

[a] Not separately available but included in total.

TABLE B-33.—*Funds for basic research performance, by field of science, 1967–69*

[Dollars in millions]

Field of science	1967	1968	1969
Total	$629	$642	$646
Physical sciences	308	317	333
Chemistry	162	191	215
Physics	(a)	(a)	(a)
Astronomy	(a)	(a)	(a)
Mathematics	12	13	12
Environmental sciences	14	11	14
Engineering (including metallurgy)	172	181	176
Life sciences	69	76	77
Biological sciences	(a)	50	52
Clinical medical sciences	(a)	26	25
Other sciences	53	43	34

[a] Not separately available but included in total.

TABLE B–34.—*Funds for basic research performance, by industry and field of science, 1969*

[Dollars in millions]

Industry	SIC code	Total	Physical sciences	Mathematics	Environmental sciences	Engineering (including metallurgy)	Life sciences	Other sciences
Total	--------	$646	$333	$12	$14	$176	$77	$34
Food and kindred products	20	11	5	--------	--------	1	3	1
Textiles and apparel	22, 23	2	1	--------	--------	--------	--------	--------
Lumber, wood products, and furniture	24, 25	(a)	(a)	(a)	(a)	(a)	(a)	(a)
Paper and allied products	26	3	(a)	--------	--------	--------	--------	--------
Chemicals and allied products	28	223	141	1	--------	17	60	3
Industrial chemicals	281–82	(a)	(a)	(a)	--------	(a)	(a)	(a)
Drugs and medicines	283	73	36	--------	--------	--------	37	--------
Other chemicals	284–89	14	11	--------	--------	--------	3	--------
Petroleum refining and extraction	29, 13	39	26	1	4	8	1	--------
Rubber products	30	5	4	--------	(a)	1	--------	--------
Stone, clay, and glass products	32	(a)	(a)	(a)	(a)	(a)	(a)	(a)
Primary metals	33	15	4	--------	--------	11	--------	--------
Ferrous metals and products	331–32, 3391, 3399	(a)	(a)	--------	--------	(a)	--------	--------
Nonferrous metals and products	333–36, 3392	7	1	--------	--------	5	--------	--------
Fabricated metal products	34	3	2	--------	--------	1	--------	--------
Machinery	35	20	11	(a)	(a)	(a)	(a)	(a)
Electrical equipment and communication	36, 48	137	49	4	--------	75	4	6
Radio and TV receiving equipment	365	(a)	(a)	--------	--------	(a)	(a)	(a)
Communication equipment and electronic components	366–67, 48	119	39	4	--------	67	(a)	(a)
Other electrical equipment	361–64, 369	(a)	(a)	--------	--------	(a)	--------	--------
Motor vehicles and other transportation equipment	371, 373–75, 379	(a)	(a)	(a)	(a)	(a)	(a)	(a)
Aircraft and missiles	372, 19	63	18	1	2	32	3	8
Professional and scientific instruments	38	(a)	(a)	(a)	(a)	(a)	(a)	(a)
Other manufacturing industries	21, 27, 31, 39	5	3	--------	--------	1	1	--------
Nonmanufacturing industries	07–12, 14–17, 41–47, 49–67, 739, 807, 891	49	(a)	(a)	(a)	(a)	(a)	(a)

---

[a] Not separately available but included in total.

TABLE B-35.—*R&D-performing companies with 5,000 or more employees and number performing basic research, by industry and size of company, 1969*[a]

Industry	SIC code	Companies with total employment of—					
		5,000 to 9,999			10,000 or more		
		Total	Basic research	Percent of total	Total	Basic research	Percent of total
Total	--------	209	88	42	306	188	61
Food and kindred products	20	16	10	63	27	14	52
Textiles and apparel	22, 23	7	4	57	16	9	56
Lumber, wood products, and furniture	24, 25	5	--------	--------	4	--------	--------
Paper and allied products	26	9	4	44	16	8	50
Chemicals and allied products	28	21	14	67	32	27	84
Industrial chemicals	281–82	3	3	100	22	18	82
Drugs and medicines	283	9	7	78	6	6	100
Other chemicals	284–89	9	4	44	4	3	75
Petroleum refining and extraction	29, 13	6	4	67	18	16	89
Rubber products	30	6	2	33	6	6	100
Stone, clay, and glass products	32	8	4	50	10	7	70
Primary metals	33	15	8	53	22	14	64
Ferrous metals and products	331–32, 3391, 3399	10	4	40	13	7	54
Nonferrous metals and products	333–36, 3392	5	4	80	9	7	78
Fabricated metal products	34	11	5	45	9	4	44
Machinery	35	24	8	32	33	18	55
Electrical equipment and communication	36, 48	24	6	25	35	24	69
Radio and TV receiving equipment	365	--------	--------	--------	4	--------	--------
Communication equipment and electronic components	366–67, 48	12	4	33	18	14	78
Other electrical equipment	361–64, 369	12	2	17	13	10	77
Motor vehicles and other transportation equipment	371, 373–75, 379	8	3	38	17	8	47
Aircraft and missiles	372, 19	4	2	50	21	13	62
Professional and scientific instruments	38	13	7	54	9	5	56
Scientific and mechanical measuring instruments	381–82	5	2	40	2	1	50
Optical, surgical, photographic, and other instruments	383–87	8	5	63	7	4	57
Other manufacturing industries	21, 27, 31, 39	11	7	64	8	5	63
Nonmanufacturing industries	07–12, 14–17, 41–47, 49–67, 739, 807, 891	21	--------	--------	23	10	43

---

[a] Companies not surveyed in 1969 which had their R&D activities estimated at the 1968 level were considered to have performed basic research in 1969.

TABLE B-36.—*Funds for applied research and development performance, by product field, 1959–69*

[Dollars in millions]

Product field	SIC code	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
Total		$9,298	$10,133	$10,514	$10,976	$12,108	$12,962	$13,592	$14,924	$15,788	$16,827	$17,829
Atomic energy devices [a]		514	613	570	565	609	709	642	627	675		
Ordnance, except guided missiles	19, except 192	106	86	79	82	92	94	103	153	218	201	186
Guided missiles and spacecraft	192	1,656	2,192	2,446	2,730	3,345	3,496	3,772	4,031	3,741	3,786	3,762
Food and kindred products	20	74	92	92	98	102	118	131	130	134	165	182
Textile mill products	22	([b])	([b])	([b])	([b])	([b])	([b])	21	42	55	58	66
Chemicals, except drugs and medicines	28, except 283	([b])	713	780	797	861	949	1,019	1,036	1,119	1,168	1,226
Industrial inorganic and organic chemicals	281	([b])	207	225	230	242	304	330	324	347	382	391
Plastics materials and synthetic resins, rubber, and fibers	282	([b])	311	328	351	379	402	420	438	474	466	482
Agricultural chemicals	287	35	27	38	42	45	48	64	77	92	99	106
Other chemicals	284–86	196	168	189	174	196	195	204	197	205	221	248
Drugs and medicines	283	145	174	191	211	227	234	274	322	346	375	411
Petroleum refining and extraction	29, 13	159	190	178	190	194	205	211	206	215	239	255
Rubber and miscellaneous plastics products	30	([b])	69	63	77	87	102	112	128	132	160	163
Stone, clay, and glass products	32	48	59	60	66	74	85	92	99	121	130	155
Primary metals	33	109	121	131	141	152	164	178	194	208	207	217
Ferrous metals and products	331–32, 3391, 3399	60	69	78	82	90	97	108	104	117	119	125
Nonferrous metals and products	333–36, 3392	49	52	53	59	62	68	70	90	91	88	92
Fabricated metal products	34	123	121	122	129	135	150	153	161	204	478	499
Machinery	35	683	755	801	829	913	970	1,113	1,254	1,293	1,396	1,650
Engines and turbines	351	87	98	100	121	124	126	138	173	192	203	206
Farm machinery and equipment	352	67	75	65	70	76	79	96	100	102	96	99
Construction, mining, and materials handling machinery	353	53	57	50	53	58	60	69	110	119	129	152
Metalworking machinery and equipment	354	39	42	46	52	58	66	52	76	67	90	83
Office, computing, and accounting machines	357	289	311	356	362	412	458	549	573	614	678	801
Other machinery, except electrical	balance of 35	148	172	184	171	185	182	209	222	199	201	308
Electrical equipment, except communication	36, except 365–67	326	271	302	263	277	305	319	375	3,083	3,403	3,391
Electric transmission and distribution equipment [c]	361	62	65	63	45	47	46	51	69			
Electrical industrial apparatus [d]	362	79	79	77	85	77	84	87	111			
Other electrical equipment and supplies	363–64, 369	185	127	162	133	152	175	181	195			
Communication equipment and electronic components	365–67	1,756	2,184	2,209	2,101	2,150	2,223	2,258	2,396			
Motor vehicles and other transportation equipment	37, except 372	594	553	519	582	651	678	713	807	831	956	1,125
Motor vehicles and equipment	371	569	530	493	558	623	651	685	757	755	860	1,019
Other transportation equipment	373–75, 379	25	23	26	24	28	27	28	50	76	96	106
Aircraft and parts	372	[e] 1,711	[e] 1,431	[e] 1,450	[e] 1,459	[e] 1,520	[e] 1,670	1,599	1,953	2,168	2,370	2,548
Professional and scientific instruments	38	191	231	227	272	298	346	372	461	535	719	791
Other product fields, not elsewhere classified		[e] 345	[e] 278	[e] 294	[e] 383	[e] 421	[e] 463	511	548	710	1,013	1,202

[a] Distributed according to SIC code from 1968 to present.

[b] Not separately available but included in total.

[c] For 1967, amount was 77; in 1968, 92; in 1969, 99.

[d] For 1967, amount was 118; in 1968, 133; in 1969, 143.

[e] Estimated by the National Science Foundation.

TABLE B-37.—*Funds for applied research and development performance in companies with 5,000 or more employees, by product field and size of company, 1969*

[Dollars in millions]

Product field	SIC code	Companies with total employment of—	
		5,000 to 9,999	10,000 or more
Total		$986	$15,178
Ordnance, except guided missiles	19, except 192	10	145
Guided missiles and spacecraft	192	13	3,633
Food and kindred products	20	19	105
Textile mill products	22	3	38
Chemicals, except drugs and medicines	28, except 283	76	928
Industrial inorganic and organic chemicals	281	14	312
Plastics materials and synthetic resins, rubber, and fibers	282	13	388
Agricultural chemicals	287	12	72
Other chemicals	284-86	37	156
Drugs and medicines	283	110	194
Petroleum refining and extraction	29, 13	12	223
Rubber and miscellaneous plastics products	30	15	113
Stone, clay, and glass products	32	12	78
Primary metals	33	15	143
Ferrous metals and products	331-32, 3391, 3399	5	78
Nonferrous metals and products	333-36 , 392	10	65
Fabricated metal products	34	29	382
Machinery	35	70	1,401
Engines and turbines	351	2	187
Farm machinery and equipment	352	1	83
Construction, mining, and materials handling machinery	353	16	110
Metalworking machinery and equipment	354	13	35
Office, computing, and accounting machines	357	13	757
Other machinery, except electrical	balance of 35	25	229
Electrical equipment and communication	36	160	2,647
Electric transmission and distribution equipment	361	3	70
Electrical industrial apparatus	362	5	126
Motor vehicles and other transportation equipment	37, except 372	13	1,064
Motor vehicles and equipment	371	11	975
Other transportation equipment	373-75, 379	2	89
Aircraft and parts	372	67	2,445
Professional and scientific instruments	38	225	338
Other product fields, not elsewhere classified		87	764
Not separately reported		50	537

61/62

TABLE B-38.—*Funds for applied research and development performance, by selected product field and source, 1969*

[Dollars in millions]

Product field	SIC code	Total	Federal	Company
Total		$17,829	$8,455	$9,375
Ordnance, except guided missiles	19, except 192	186	155	31
Guided missiles and spacecraft	192	3,762	3,355	407
Textile mill products	22	66	1	65
Chemicals, except drugs and medicines	28, except 283	1,226	50	1,176
Industrial inorganic and organic chemicals	281	391	26	365
Plastics materials and synthetic resins, rubber, and fibers	282	482	15	467
Machinery	35	1,650	107	1,543
Office, computing, and accounting machines	357	801	55	746
Aircraft and parts	372	2,548	1,243	1,305
Professional and scientific instruments	38	791	333	458

TABLE B-39.—*Funds for applied research and development*

[Dollars in

Industry	SIC code	Total	Product field and SIC code					
			Ordnance, except guided missiles	Guided missiles and spacecraft	Food and kindred products	Textile mill products	Chemicals, except drugs and medicines	Drugs and medicines
		—	(19, except 192)	(192)	(20)	(22)	(28, except 283)	(283)
Total	-------------	$17,829	$186	$3,762	$182	$66	$1,226	$411
Food and kindred products	20	174	-------	-------	137	1	14	-------
Textiles and apparel	22, 23	58	-------	-------	-------	31	(a)	-------
Lumber, wood products, and furniture	24, 25	23	(a)	(a)	(a)	(a)	(a)	(a)
Paper and allied products	26	110	-------	-------	-------	-------	4	-------
Chemicals and allied products	28	1,529	(a)	(a)	27	13	844	369
Industrial chemicals	281–82	(a)	(a)	(a)	(a)	(a)	(a)	(a)
Drugs and medicines	283	364	-------	-------	6	-------	43	298
Other chemicals	284–89	236	(a)	(a)	14	-------	152	35
Petroleum refining and extraction	29, 13	533	1	16	2	1	131	2
Rubber products	30	235	-------	26	-------	12	46	4
Stone, clay, and glass products	32	(a)	(a)	(a)	(a)	(a)	(a)	(a)
Primary metals	33	251	-------	-------	(a)	(a)	18	(a)
Ferrous metals and products	331–32, 3391, 3399	(a)	-------	-------	(a)	(a)	(a)	(a)
Nonferrous metals and products	333–36, 3392	118	-------	-------	-------	-------	9	-------
Fabricated metal products	34	180	1	2	3	-------	17	2
Machinery	35	1,726	6	91	1	-------	17	1
Electrical equipment and communication	36, 48	4,157	61	601	(a)	(a)	37	(a)
Radio and TV receiving equipment	365	(a)	(a)	(a)	(a)	(a)	(a)	(a)
Communication equipment and electronic components	366–67, 48	2,336	22	(a)	-------	-------	8	1
Other electrical equipment	361–64, 369	(a)	(a)	(a)	(a)	(a)	(a)	(a)
Motor vehicles and other transportation equipment	371,373–75,379	(a)	(a)	(a)	(a)	(a)	(a)	(a)
Aircraft and missiles	372, 19	5,737	29	2,959	1	-------	20	3
Professional and scientific instruments	38	(a)	(a)	(a)	(a)	(a)	(a)	(a)
Other manufacturing industries	21, 27, 31, 39	91	1	-------	4	-------	7	-------
Nonmanufacturing industries	07–12, 14–17, 41–47, 49–67, 739, 807, 891	591	9	18	2	2	13	3

(a) Not separately available but included in total.

performance, by industry and product field, 1969

millions]

Product field and SIC code—Continued										
Petroleum refining and extraction	Rubber products	Stone, clay, and glass products	Primary metals	Fabricated metal products	Machinery	Electrical equipment and communication	Motor vehicles and other transportation equipment	Aircraft and parts	Professional and scientific instruments	Other product fields, N.E.C.
(29, 13)	(30)	(32)	(33)	(34)	(35)	(36)	(37, except 372)	(372)	(38)	—
$255	$163	$155	$217	$499	$1,650	$3,391	$1,125	$2,548	$791	$1,202
---------	---------	2	---------	1	11	(a)	---------	---------	---------	6
---------	2	---------	---------	1	(a)	---------	---------	---------	---------	18
(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
---------	2	---------	---------	1	13	---------	---------	---------	---------	88
(a)	12	13	(a)	28	19	15	1	14	10	110
(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
---------	2	1	1	1	(a)	(a)	---------	---------	4	6
---------	1	3	---------	1	---------	---------	---------	12	---------	16
227	2	1	2	28	14	(a)	(a)	81	3	12
1	101	1	---------	4	5	27	1	5	---------	2
(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
1	1	3	157	28	13	11	6	1	(a)	9
---------	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
1	---------	2	57	18	9	9	(a)	(a)	1	6
1	4	3	5	72	24	11	4	5	4	23
4	(a)	2	8	28	1,073	283	43	30	3	133
---------	1	9	11	235	269	2,078	22	294	196	340
---------	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
---------	---------	3	2	9	124	1,402	14	8	122	293
---------	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
---------	(a)	(a)	4	37	49	396	48	2,008	9	165
(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
---------	3	---------	---------	3	13	5	1	---------	1	53
10	1	2	5	7	17	185	9	31	112	165

TABLE B-40.—*Funds for applied research and development*

[Dollars in

Industry	SIC code	Total	Product field and SIC code					
			Ordnance, except guided missiles	Guided missiles and spacecraft	Food and kindred products	Textile mill products	Chemicals, except drugs and medicines	Drugs and medicines
		—	(19, except 192)	(192)	(20)	(22)	(28, except 283)	(283)
Total	-------------	$16,827	$201	$3,786	$165	$58	$1,168	$375
Food and kindred products	20	157	--------	--------	122	1	17	--------
Textiles and apparel	22, 23	57	--------	--------	--------	34	(a)	1
Lumber, wood products, and furniture	24, 25	21	(a)	(a)	(a)	(a)	(a)	(a)
Paper and allied products	26	90	--------	--------	--------	--------	4	--------
Chemicals and allied products	28	1,445	(a)	(a)	26	11	796	339
Industrial chemicals	281–82	(a)	(a)	(a)	(a)	(a)	(a)	(a)
Drugs and medicines	283	330	--------	--------	6	--------	38	271
Other chemicals	284–89	222	--------	--------	13	--------	144	28
Petroleum refining and extraction	29, 13	501	1	38	2	1	130	2
Rubber products	30	225	--------	21	--------	4	40	3
Stone, clay, and glass products	32	(a)	(a)	(a)	(a)	(a)	(a)	(a)
Primary metals	33	236	(a)	--------	(a)	(a)	14	(a)
Ferrous metals and products	331–32, 3391, 3399	(a)	(a)	--------	(a)	(a)	(a)	(a)
Nonferrous metals and products	333–36, 3392	110	(a)	--------	--------	--------	7	--------
Fabricated metal products	34	180	1	2	3	--------	17	2
Machinery	35	1,581	7	95	1	--------	15	1
Electrical equipment and communication	36, 48	3,913	57	555	(a)	(a)	29	(a)
Radio and TV receiving equipment	365	(a)	(a)	(a)	(a)	(a)	(a)	(a)
Communication equipment and electronic components	366–67, 48	2,207	22	(a)	--------	--------	6	1
Other electrical equipment	361–64, 369	(a)	(a)	(a)	(a)	(a)	(a)	(a)
Motor vehicles and other transportation equipment	371, 373–75, 379	(a)	(a)	(a)	(a)	(a)	(a)	(a)
Aircraft and missiles	372, 19	5,591	40	2,985	2	--------	28	2
Professional and scientific instruments	38	(a)	(a)	(a)	(a)	(a)	(a)	(a)
Other manufacturing industries	21, 27, 31, 39	84	1	--------	3	--------	7	--------
Nonmanufacturing industries	07–12, 14–17, 41–47, 49–67, 739, 807, 891	534	6	22	2	2	15	3

---

[a] Not separately available but included in total.

performance, by industry and product field, 1968

millions]

Product field and SIC code—Continued										
Petroleum refining and extraction	Rubber products	Stone, clay, and glass products	Primary metals	Fabricated metal products	Machinery	Electrical equipment and communication	Motor vehicles and other transportation equipment	Aircraft and parts	Professional and scientific instruments	Other product fields, N.E.C.
(29, 13)	(30)	(32)	(33)	(34)	(35)	(36)	(37, except 372)	(372)	(38)	—
$239	$160	$130	$207	$478	$1,396	$3,403	$956	$2,370	$719	$1,013
---	---	2	---	1	10	(a)	---	---	---	3
---	1	---	---	1	(a)	---	---	---	---	11
(a)	(a)	(a)	(a)	(a)	(a)	---	(a)	(a)	(a)	(a)
---	2	---	---	---	6	---	---	---	---	76
(a)	9	12	(a)	24	21	15	1	17	9	108
(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
---	1	1	1	1	(a)	(a)	---	---	4	5
---	2	3	---	1	---	---	---	17	---	13
213	2	1	3	22	6	(a)	(a)	60	4	9
2	105	1	1	2	8	29	---	6	---	3
(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
1	2	2	151	28	12	10	5	1	(a)	8
---	(a)	---	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
1	---	2	55	17	8	8	(a)	(a)	1	5
1	3	3	4	65	24	18	5	5	4	23
3	---	2	6	28	885	361	41	32	3	99
1	1	6	12	228	233	1,973	16	309	194	295
(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
---	---	2	2	11	118	1,351	9	33	130	246
(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
---	(a)	(a)	4	46	43	435	53	1,822	7	114
(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
---	1	---	---	3	13	6	1	---	2	47
7	2	2	3	6	16	166	4	32	106	139

TABLE B–41.—*Funds for applied research and development performance,*

[Dollars in

Industry	SIC code	Chemicals, except drugs and medicines				Primary metals	
		Industrial inorganic and organic chemicals	Plastics materials and synthetic resins, rubber and fibers	Agricultural chemicals	Other chemicals	Ferrous metals and products	Nonferrous metals and products
		(281)	(282)	(287)	(284–86)	(331, 332, 3391 and 3399)	(333–36, 3392)
Total	--------------	$391	$482	$106	$248	$125	$92
Food and kindred products	20	5	7	1	2	---------	---------
Textiles and apparel	22, 23	(a)	5	---------	(a)	---------	---------
Lumber, wood products, and furniture	24, 25	(a)	(a)	(a)	(a)	(a)	(a)
Paper and allied products	26	(a)	(a)	---------	2	---------	---------
Chemicals and allied products	28	244	336	81	184	(a)	(a)
Industrial chemicals	281–82	(a)	(a)	(a)	(a)	(a)	(a)
Drugs and medicines	283	8	4	15	16	---------	---------
Other chemicals	284–89	20	17	25	90	---------	---------
Petroleum refining and extraction	29, 13	53	37	15	26	(a)	(a)
Rubber products	30	13	29	(a)	(a)	---------	(a)
Stone, clay, and glass products	32	(a)	(a)	(a)	(a)	(a)	(a)
Primary metals	33	11	2	1	3	97	60
Ferrous metals and products	331–32, 3391, 3399	(a)	(a)	(a)	(a)	(a)	(a)
Nonferrous metals and products	333–36, 3392	7	(a)	(a)	(a)	(a)	(a)
Fabricated metal products	34	4	8	---------	5	3	2
Machinery	35	3	3	---------	11	2	5
Electrical equipment and communication	36, 48	18	16	(a)	2	7	4
Radio and TV receiving equipment	365	(a)	(a)	(a)	(a)	(a)	(a)
Communication equipment and electronic components	366–67, 48	4	2	(a)	(a)	(a)	(a)
Other electrical equipment	361–64, 369	(a)	(a)	(a)	(a)	(a)	(a)
Motor vehicles and other transportation equipment	371, 373–75, 379	(a)	(a)	(a)	(a)	(a)	(a)
Aircraft and missiles	372, 19	(a)	7	1	(a)	---------	4
Professional and scientific instruments	38	(a)	(a)	(a)	(a)	(a)	(a)
Scientific and mechanical measuring instruments	381–82	-------	(a)	(a)	(a)	(a)	(a)
Optical, surgical, photographic, and other instruments	383–87	(a)	1	---------	---------	---------	---------
Other manufacturing industries	21, 27, 31, 39	1	4	(a)	(a)	---------	---------
Nonmanufacturing industries	07–12, 14–17, 41–47, 49–67, 739, 807, 891	9	1	1	2	3	1

---

[a] Not separately available but included in total.

by industry and secondary product field, 1969

millions]

Machinery						Electrical equipment, except communication		Motor vehicles and other transportation equipment	
Engines and turbines	Farm machinery and equipment	Construction, mining, and materials handling machinery	Metalworking machinery and equipment	Office, computing and accounting machines	Other machinery, except electrical	Electric transmission and distribution equipment	Electrical industrial apparatus	Motor vehicles and equipment	Other transportation equipment
(351)	(352)	(353)	(354)	(357)	(balance of 35)	(361)	(362)	(371)	(373–75 and 379)
$206	$99	$152	$83	$801	$308	$99	$143	$1,019	$106
----------	1	----------	----------	----------	10	----------	(a)	----------	----------
----------	----------	----------	----------	----------	(a)	----------	----------	----------	----------
(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
----------	----------	----------	----------	(a)	12	----------	----------	----------	----------
(a)	(a)	(a)	(a)	----------	10	----------	6	1	----------
(a)	(a)	(a)	(a)	----------	(a)	----------	(a)	(a)	----------
----------	----------	----------	----------	----------	(a)	----------	(a)	----------	----------
----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
(a)	----------	(a)	----------	----------	14	----------	(a)	(a)	(a)
----------	----------	----------	----------	----------	5	(a)	(a)	1	----------
(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
2	(a)	1	7	(a)	3	2	2	4	2
(a)	(a)	(a)	----------	(a)	(a)	(a)	(a)	(a)	(a)
(a)	----------	----------	7	----------	----------	(a)	1	(a)	1
(a)	(a)	5	7	1	9	----------	4	(a)	(a)
97	75	120	40	562	178	3	7	39	4
38	----------	4	8	190	29	79	76	4	18
(a)	----------	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
(a)	----------	(a)	5	106	12	9	8	(a)	(a)
(a)	----------	(a)	(a)	83	(a)	(a)	(a)	(a)	(a)
(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
23	(a)	----------	8	3	(a)	(a)	(a)	8	41
(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	----------
----------	----------	----------	2	(a)	(a)	(a)	(a)	(a)	(a)
3	----------	----------	(a)	(a)	7	(a)	(a)	1	----------
6	----------	3	(a)	5	1	8	4	4	4

TABLE B-42.—*Funds for applied research and development performance, by*

[Dollars in

Industry	SIC code	Chemicals, except drugs and medicines				Primary metals	
		Industrial inorganic and organic chemicals	Plastics materials and synthetic resins, rubber and fibers	Agricultural chemicals	Other chemicals	Ferrous metals and products	Nonferrous metals and products
		(281)	(282)	(287)	(284–86)	(331, 332, 3391 and 3399)	(333–36, 3392)
Total	--------	$382	$466	$99	$221	$119	$88
Food and kindred products	20	5	8	1	3	--------	--------
Textiles and apparel	22, 23	([a])	6	--------	([a])	--------	--------
Lumber, wood products, and furniture	24, 25	([a])	([a])	([a])	([a])	([a])	([a])
Paper and allied products	26	([a])	([a])	--------	2	--------	--------
Chemicals and allied products	28	228	329	78	161	([a])	([a])
Industrial chemicals	281–82	([a])	([a])	([a])	([a])	([a])	([a])
Drugs and medicines	283	8	4	14	12	--------	([a])
Other chemicals	284–89	18	17	23	86	--------	--------
Petroleum refining and extraction	29, 13	54	37	14	25	([a])	([a])
Rubber products	30	15	21	([a])	([a])	--------	([a])
Stone, clay, and glass products	32	([a])	([a])	([a])	([a])	([a])	([a])
Primary metals	33	9	2	--------	3	93	58
Ferrous metals and products	331–32, 3391, 3399	([a])	([a])	([a])	([a])	([a])	([a])
Nonferrous metals and products	333–36, 3392	5	([a])	([a])	([a])	([a])	([a])
Fabricated metal products	34	4	8	--------	4	2	2
Machinery	35	3	2	--------	10	3	3
Electrical equipment and communication	36, 48	13	14	([a])	1	8	4
Radio and TV receiving equipment	365	([a])	([a])	([a])	([a])	([a])	([a])
Communication equipment and electronic components	366–67, 48	4	2	--------	--------	([a])	([a])
Other electrical equipment	361–64, 369	([a])	([a])	([a])	([a])	([a])	([a])
Motor vehicles and other transportation equipment	371, 373–75, 379	([a])	([a])	([a])	([a])	([a])	([a])
Aircraft and missiles	372, 19	([a])	8	1	([a])	--------	4
Professional and scientific instruments	38	([a])	([a])	([a])	([a])	([a])	([a])
Scientific and mechanical measuring instruments	381–82	--------	--------	--------	--------	--------	--------
Optical, surgical, photographic, and other instruments	383–87	([a])	([a])	([a])	([a])	([a])	([a])
Other manufacturing industries	21, 27, 31, 39	2	3	([a])	([a])	--------	--------
Nonmanufacturing industries	07–12, 14–17, 41–47, 49–67, 739, 807, 891	10	2	1	3	2	1

---

[a] Not separately available but included in total.

industry and secondary product field, 1968

millions]

Machinery						Electrical equipment, except communication		Motor vehicles and other transportation equipment	
Engines and turbines	Farm machinery and equipment	Construction, mining, and materials handling machinery	Metal-working machinery and equipment	Office, computing and accounting machines	Other machinery, except electrical	Electric transmission and distribution equipment	Electrical industrial apparatus	Motor vehicles and equipment	Other transportation equipment
(351)	(352)	(353)	(354)	(357)	(balance of 35)	(361)	(362)	(371)	(373–75 and 379)
$203	$96	$129	$90	$678	$201	$92	$133	$860	$96
-----	1	-----	-----	-----	9	-----	-----	-----	-----
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
-----	-----	-----	-----	(a)	5	-----	-----	-----	-----
(a)	(a)	(a)	(a)	(a)	11	-----	5	1	-----
(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
-----	-----	-----	-----	(a)	(a)	-----	(a)	-----	-----
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
(a)	-----	(a)	-----	-----	6	-----	(a)	(a)	-----
-----	-----	-----	-----	-----	7	(a)	(a)	-----	-----
(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
2	(a)	1	6	(a)	3	1	2	3	2
(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
(a)	-----	-----	6	-----	-----	(a)	1	(a)	(a)
(a)	(a)	5	7	(a)	9	-----	3	(a)	(a)
112	69	106	38	478	83	5	5	37	4
37	1	1	6	161	27	74	73	6	10
(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
(a)	(a)	-----	3	101	10	8	11	(a)	(a)
(a)	(a)	(a)	(a)	59	(a)	(a)	(a)	(a)	(a)
(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
12	(a)	-----	18	-----	(a)	(a)	(a)	7	46
(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
-----	-----	-----	2	-----	(a)	(a)	(a)	(a)	-----
(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
3	-----	-----	(a)	(a)	7	-----	(a)	1	-----
5	-----	1	(a)	5	2	6	4	2	2

TABLE B-43.—*Geographic distribution of funds for industrial R&D performance, 1962–69*

[Dollars in millions]

Area	1962	1963	1964	1965	1966	1967	1968	1969
UNITED STATES, TOTAL	$11,464	$12,630	$13,512	$14,185	$15,548	$16,415	$17,469	$18,474
NORTHEAST	3,600	3,818	4,105	4,385	5,092	5,468	5,907	6,165
New England	952	993	1,072	1,175	1,494	1,661	1,870	1,852
Maine	2	4	5	6	5	8	9	7
New Hampshire	6	6	7	8	27	49	43	50
Vermont	7	6	7	11	15	14	20	32
Massachusetts	486	481	526	616	826	915	986	1,009
Rhode Island	7	7	9	9	9	14	17	23
Connecticut	445	489	518	526	612	663	795	731
Middle Atlantic	2,648	2,825	3,034	3,210	3,598	3,807	4,037	4,313
New York	1,157	1,176	1,334	1,429	1,573	1,718	1,830	1,979
New Jersey	819	958	959	1,005	1,119	1,098	1,117	1,189
Pennsylvania	672	691	741	777	906	941	1,090	1,145
NORTH CENTRAL	2,490	2,791	2,877	2,978	3,382	3,638	3,766	4,166
East North Central	2,091	2,230	2,312	2,500	2,857	3,157	3,291	3,555
Ohio	592	583	588	648	774	879	910	940
Indiana	221	236	243	278	316	377	386	420
Illinois	377	398	417	448	539	612	625	653
Michigan	761	862	908	962	1,049	1,089	1,162	1,311
Wisconsin	140	149	155	164	179	201	208	231
West North Central	398	562	565	478	525	480	475	611
Minnesota	135	149	180	186	225	239	250	295
Iowa	39	58	76	73	103	75	71	88
Missouri	193	304	287	193	156	125	99	180
North Dakota	----------	----------	----------	----------	----------	----------	----------	----------
South Dakota	(a)	(a)	1	(a)	(a)	(a)	(a)	(a)
Nebraska	(a)	(a)	2	(a)	(a)	(a)	(a)	(a)
Kansas	28	47	18	20	30	34	45	40
SOUTH	1,516	1,701	2,076	2,227	2,437	2,414	2,531	2,481
South Atlantic	996	931	925	1,015	1,179	1,220	1,304	1,417
Delaware	(a)	26	26	36	41	37	26	36
Maryland	241	267	276	275	254	310	301	342
District of Columbia	10	12	14	18	19	23	47	35
Virginia	81	93	93	123	(a)	(a)	(a)	(a)
West Virginia	91	89	71	53	59	63	61	57
North Carolina	62	71	71	81	124	120	138	165
South Carolina	34	28	31	32	47	48	51	54
Georgia	(a)	61	71	75	(a)	(a)	(a)	(a)
Florida	236	284	273	323	338	375	436	445
East South Central	221	280	305	416	487	473	416	383
Kentucky	19	22	35	36	41	48	51	54
Tennessee	127	139	136	158	206	221	199	201
Alabama	73	116	132	221	238	203	164	125
Mississippi	1	2	2	1	2	2	2	3
West South Central	299	491	846	796	771	721	811	681
Arkansas	3	2	2	1	5	5	6	6
Louisiana	55	131	282	255	237	154	127	104
Oklahoma	39	53	93	121	99	83	71	67
Texas	202	304	469	419	430	479	607	504
WEST	3,859	4,320	4,453	4,594	4,635	4,897	5,264	5,663
Mountain	422	465	473	457	446	489	596	684
Montana	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
Idaho	18	27	29	28	(a)	(a)	(a)	(a)
Wyoming	2	1	1	(a)	2	2	2	3
Colorado	103	126	109	105	108	119	139	156
New Mexico	(a)	(a)	185	168	146	154	151	188
Arizona	65	86	97	110	116	125	180	202
Utah	105	71	29	22	18	21	21	26
Nevada	(a)	(a)	(a)	21	38	52	55	49
Pacific	3,437	3,854	3,981	4,137	4,189	4,407	4,668	4,978
Washington	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
Oregon	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
California	3,029	3,512	3,754	3,768	(a)	(a)	(a)	(a)
Alaska	----------	----------	----------	----------	----------	----------	----------	(a)
Hawaii	(a)	(a)	(a)	(a)	3	(a)	(a)	(a)

---

[a] Not separately available but included in total.

TABLE B-44.—*Geographic distribution of funds for industrial R&D performance, by source of funds, 1969*

[Dollars in millions]

Area	Total		Federal		Company	
	Amount	Percent of U.S. total	Amount	Percent of U.S. total	Amount	Percent of U.S. total
UNITED STATES, TOTAL	$18,474	100	$8,619	100	$9,856	100
NORTHEAST	6,165	33	2,559	30	3,606	37
New England	1,852	10	982	11	870	9
Maine	7	(a)	----------	(a)	7	(a)
New Hampshire	50	(a)	44	1	6	(a)
Vermont	32	(a)	(b)	(b)	(b)	(b)
Massachusetts	1,009	5	526	6	483	5
Rhode Island	23	(a)	(b)	(b)	(b)	(b)
Connecticut	731	4	(b)	(b)	(b)	(b)
Middle Atlantic	4,313	23	1,577	18	2,736	28
New York	1,979	11	818	9	1,161	12
New Jersey	1,189	6	346	4	843	9
Pennsylvania	1,145	6	413	5	732	7
NORTH CENTRAL	4,166	23	716	8	3,450	35
East North Central	3,555	19	497	6	3,058	31
Ohio	940	5	253	3	687	7
Indiana	420	2	91	1	329	3
Illinois	653	4	26	(a)	627	6
Michigan	1,311	7	83	1	1,228	12
Wisconsin	231	1	44	1	187	2
West North Central	611	3	219	3	392	4
Minnesota	295	2	93	1	202	2
Iowa	88	(a)	(b)	(b)	(b)	(b)
Missouri	180	1	100	1	80	1
North Dakota	----------	----------	----------	----------	----------	----------
South Dakota	(b)	(b)	(b)	(b)	(b)	(b)
Nebraska	(b)	(b)	(b)	(b)	(b)	(b)
Kansas	40	(a)	(b)	(b)	(b)	(b)
SOUTH	2,481	13	1,336	16	1,145	12
South Atlantic	1,417	8	800	9	617	6
Delaware	36	(a)	(b)	(b)	(b)	(b)
Maryland	342	2	215	2	127	1
District of Columbia	35	(a)	(b)	(b)	(b)	(b)
Virginia	(b)	(b)	(b)	(b)	(b)	(b)
West Virginia	57	(a)	(b)	(b)	(b)	(b)
North Carolina	165	(b)	(b)	(b)	(b)	(b)
South Carolina	54	(a)	(b)	(b)	(b)	(b)
Georgia	(b)	(b)	(b)	(b)	(b)	(b)
Florida	445	2	328	3	117	1
East South Central	383	2	235	3	148	2
Kentucky	54	(a)	(b)	(b)	(b)	(b)
Tennessee	201	1	(b)	(b)	(b)	(b)
Alabama	125	1	101	1	24	(a)
Mississippi	3	(a)	----------	(a)	3	(a)
West South Central	681	4	301	3	380	4
Arkansas	6	(a)	(b)	(b)	(b)	(b)
Louisiana	104	1	(b)	(b)	(b)	(b)
Oklahoma	67	(a)	(b)	(b)	(b)	(b)
Texas	504	3	210	2	294	3
WEST	5,663	31	4,007	46	1,654	17
Mountain	684	4	445	5	239	2
Montana	(b)	(b)	(b)	(b)	(b)	(b)
Idaho	(b)	(b)	(b)	(b)	(b)	(b)
Wyoming	3	(a)	----------	----------	3	(a)
Colorado	156	1	69	1	87	1
New Mexico	188	1	(b)	(b)	(b)	(b)
Arizona	202	1	86	1	116	1
Utah	26	(a)	14	(a)	12	(a)
Nevada	49	(a)	(b)	(b)	(b)	(b)
Pacific	4,978	27	3,562	41	1,415	14
Washington	(b)	(b)	(b)	(b)	(b)	(b)
Oregon	(b)	(b)	(b)	(b)	(b)	(b)
California	(b)	(b)	(b)	(b)	(b)	(b)
Alaska	(b)	(b)	(b)	(b)	(b)	(b)
Hawaii	(b)	(b)	(b)	(b)	(b)	(b)

[a] Less than 0.5 percent.

[b] Not separately available but included in total.

TABLE B-45.—*Cost per R&D scientist or engineer, by industry and size of company, 1957–69*[a]

Industry and size of company	SIC code	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
Total		$32,700	$32,800	$34,300	$34,800	$35,000	$35,900	$37,800	$39,500	$40,400	$43,200	$43,400	$45,900	$48,200
Distribution by industry														
Food and kindred products	20	17,200	16,800	18,600	21,000	23,700	23,200	25,200	25,700	26,100	27,300	29,500	29,800	31,400
Textiles and apparel	22, 23	20,000	28,900	30,000	36,200	24,000	22,900	26,400	26,000	27,400	30,900	27,900	22,700	22,900
Lumber, wood products, and furniture	24, 25	17,500	13,300	14,200	16,800	19,200	20,000	22,000	20,900	22,800	21,700	21,200	24,300	21,100
Paper and allied products	26	21,900	22,700	22,200	22,400	22,700	25,200	27,000	28,500	30,000	32,600	32,500	32,500	40,500
Chemicals and allied products	28	23,300	24,600	25,600	26,800	30,000	31,500	32,600	33,400	34,700	37,100	39,100	39,900	41,700
Industrial chemicals	281–82	27,400	28,400	28,500	29,800	31,800	33,200	34,800	35,500	37,100	40,300	43,100	44,000	45,900
Drugs and medicines	283	21,200	23,300	25,800	26,500	27,600	28,400	30,200	31,700	33,800	36,800	36,700	38,900	41,100
Other chemicals	284–89	14,200	15,300	17,400	18,700	26,900	29,300	27,900	27,700	26,900	26,700	29,300	29,200	30,500
Petroleum refining and extraction	29, 13	29,500	32,600	32,800	32,500	33,000	34,300	35,400	44,000	44,200	41,700	43,700	46,000	48,400
Rubber products	30	22,800	18,700	22,700	22,200	24,700	24,700	26,500	27,000	27,900	31,000	32,800	37,500	38,300
Stone, clay, and glass products	32	(b)	(b)	(b)	(b)	23,800	25,400	26,000	26,600	27,500	29,400	29,600	30,900	34,000
Primary metals	33	21,000	24,000	24,300	25,800	27,400	30,700	35,700	36,600	38,700	40,700	41,200	42,200	42,200
Ferrous metals and products[d]	331–32, 3391, 3399	21,700	24,600	23,000	26,400	28,400	33,100	37,400	38,600	40,100	(c)	43,000	42,500	43,700
Nonferrous metals and products	333–36, 3392	20,000	23,200	26,000	24,900	26,300	28,000	33,500	34,300	36,700	(c)	39,100	40,300	40,600
Fabricated metal products	34	16,200	18,800	16,900	18,000	17,000	20,600	22,200	21,700	22,400	24,400	24,300	29,800	29,400
Machinery	35	25,600	27,500	30,200	29,000	27,900	29,000	31,000	33,300	33,900	36,200	36,300	41,400	40,300
Electrical equipment and communication	36, 48	39,700	38,200	36,700	33,500	30,800	31,400	33,000	34,000	35,700	38,400	39,100	40,900	42,600
Radio and TV receiving equipment	365	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(c)	50,100	51,000	52,600
Communication equipment and electronic components	366–67, 48	36,000	34,600	33,900	30,000	28,000	29,500	31,700	32,900	33,800	36,100	36,300	37,400	39,100
Other electrical equipment	361–64, 369	42,800	41,900	40,100	38,300	35,100	34,700	35,400	36,000	39,200	(c)	43,700	46,600	48,100
Motor vehicles and other transportation equipment	371, 373–75, 379	49,400	53,800	56,100	47,900	46,900	47,700	49,400	50,100	50,900	54,000	55,700	63,000	68,900
Aircraft and missiles	372, 19	43,900	41,900	44,700	46,600	48,500	47,500	49,600	51,400	51,700	55,700	54,900	57,700	61,800
Professional and scientific instruments	38	23,500	25,600	28,000	31,100	28,400	32,100	29,900	32,600	36,000	38,400	39,300	44,700	49,600
Scientific and mechanical measuring instruments	381–82	22,600	23,100	25,400	28,500	22,500	23,100	18,400	20,500	21,400	22,400	24,400	25,000	26,300
Optical, surgical, photographic, and other instruments	383–87	24,700	29,100	31,500	34,200	34,400	39,700	37,500	39,200	43,200	44,900	44,800	52,100	57,300
Other manufacturing industries	21, 27, 31, 39	(c)	(c)	15,300	23,200	32,000	22,000	23,700	27,400	27,000	28,400	29,800	35,200	35,400
Nonmanufacturing industries	07–12, 14–17, 41–47, 49–67, 739, 807, 891	(c)	(c)	15,300	23,200	27,000	30,900	31,000	33,500	36,700	39,400	39,100	39,900	44,200
Distribution by size of company (based on number of employees)														
Less than 1,000		11,600	12,000	13,900	14,300	15,600	18,000	18,600	19,300	22,500	21,600	23,600	26,500	(c)
1,000 to 4,999		[f] 27,200	25,100	26,000	28,000	27,400	28,200	29,400	31,300	33,400	34,400	35,000	35,500	(c)
5,000 to 9,999		[f] 39,400	38,700	39,200	39,400	39,200	39,500	41,400	42,300	43,400	46,100	35,900	39,000	42,300
10,000 or more												47,000	49,300	51,600

---

[a] The number of R&D scientists and engineers in 1966 was the arithmetic mean of the full-time-equivalent number employed in January 1966 and January 1967. Data for 1957–65 were derived in the same way. For 1967 to present, figures are man-years.

[b] Included in the other manufacturing industries group.

[c] Not separately available but included in total.

[d] SIC codes 3391 and 3399 included in the nonferrous metals and products group for 1957 to 1966.

[e] Included in the other electrical equipment group.

[f] Estimated by the National Science Foundation.

82

TABLE B-46.—*Cost per R&D scientist or engineer, by industry and selected company size groups, 1969*

Industry	SIC code	Companies with total employment of—		
		Total	5,000 to 9,999	10,000 or more
Total		$48,200	$42,300	$51,600
Food and kindred products	20	31,400	36,000	31,200
Textiles and apparel	22, 23	22,900	40,000	29,200
Lumber, wood products, and furniture	24, 25	21,100	([a])	([a])
Paper and allied products	26	40,500	36,700	44,700
Chemical and allied products	28	41,700	38,400	45,300
Industrial chemicals	281–82	45,900	33,300	47,100
Drugs and medicines	283	41,100	41,000	43,500
Other chemicals	284–89	30,500	31,100	35,800
Petroleum refining and extraction	29, 13	48,400	36,700	50,700
Rubber products	30	38,300	43,800	41,900
Stone, clay, and glass products	32	34,000	34,000	36,800
Primary metals	33	42,200	36,700	44,800
Ferrous metals and products	331–32, 3391, 3399	43,700	([a])	45,800
Nonferrous metals and products	333–36, 3392	40,600	([a])	34,300
Fabricated metal products	34	29,400	21,700	32,000
Machinery	35	40,300	40,000	43,100
Electrical equipment and communication	36, 48	42,600	40,500	44,200
Radio and TV receiving equipment	365	52,600	--------	55,600
Communication equipment and electronic components	366–67, 48	39,100	37,200	30,900
Other electrical equipment	361–64, 369	48,100	49,400	51,300
Motor vehicles and other transportation equipment	371, 373–75, 379	68,900	28,300	70,600
Aircraft and missiles	372, 19	61,800	44,300	62,800
Professional and scientific instruments	38	49,600	68,900	42,900
Scientific and mechanical measuring instruments	381–82	26,300	([a])	([a])
Optical, surgical, photographic, and other instruments	383–87	57,300	([a])	([a])
Other manufacturing industries	21, 27, 31, 39	35,400	36,000	35,000
Nonmanufacturing industries	07–12, 14–17, 41–47, 49–67, 739, 807, 891	44,200	57,000	31,000

[a] Not separately available but included in total.

TABLE B-47.—*Cost per R&D scientist or engineer in manufacturing companies with the largest R&D programs, 1959–69*[a]

Companies ranked by size of R&D program (based on total R&D funds)[b]	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
First 4	$57,200	$59,400	$59,700	$54,300	$51.700	$56,700	$59,300	$60,700	$57,200	$60,900	$64,900
First 8	50.200	52,600	52,900	54,600	53,400	54,900	55,700	57,600	55,100	58,400	62,300
First 20	47,500	47,700	45,700	46,500	48,300	49,200	51,500	55,000	54,600	57,500	61,800
First 40	43,700	44,100	42,800	43,700	45,300	46,800	48,000	50,600	50,900	53,900	57,200
First 100	41,000	41,600	40,100	41,300	43,500	44,800	46,000	48,500	49,100	51,600	54,600
First 200	39,500	40,500	39,000	40,000	42,300	43,200	44,400	47,100	47,500	50,100	52,700
First 300	38,900	39.400	38,300	39,300	41,700	42,600	43,800	46,400	46,900	49,100	51,900
Average, all manufacturing companies	35,600	35,900	35,200	36,000	38,000	39,100	40,500	43,900	43,600	46,100	48,400
Other manufacturing companies	19,600	18,700	17,900	18,900	20,200	20,100	21,800	23,500	21,100	26,600	22,400

[a] See table 45, footnote *a*.

[b] Company rankings were made independently of one another. Thus, the individual companies comprising a particular group in the current year may differ from those in the group for earlier years.

Table B-48.—*Total employment of R&D-performing companies, by industry and selected company size groups, 1968 and 1969*

[thousands]

Industry	SIC code	1968			1969		
		Total	Companies with total employment of—		Total	Companies with total employment of—	
			5,000 to 9,999	10,000 or more		5,000 to 9,999	10,000 or more
Total		14,425	1,400	10,249	14,792	1,465	10,532
Food and kindred products	20	779	104	533	829	104	581
Textiles and apparel	22, 23	633	(a)	(a)	639	(a)	(a)
Lumber, wood products, and furniture	24, 25	201	(a)	(a)	209	(a)	(a)
Paper and allied products	26	473	60	340	489	61	355
Chemicals and allied products	28	1,145	142	820	1,175	150	832
Industrial chemicals	281–82	710	23	633	721	25	640
Drugs and medicines	283	198	53	100	213	60	105
Other chemicals	284–89	237	66	87	241	65	87
Petroleum refining and extraction	29, 13	627	41	560	627	42	558
Rubber products	30	355	41	234	368	43	243
Stone, clay, and glass products	32	392	55	230	421	59	254
Primary metals	33	1,110	113	847	1,112	114	851
Ferrous metals and products	331–32, 3391, 3399	766	(a)	(a)	757	(a)	(a)
Nonferrous metals and products	333–36, 3392	344	(a)	(a)	355	(a)	(a)
Fabricated metal products	34	514	66	217	523	71	219
Machinery	35	1,492	141	898	1,569	166	951
Electrical equipment and communication	36, 48	2,203	167	1,695	2,273	172	1,759
Radio and TV receiving equipment	365	93		72	93		73
Communication equipment and electronic components	366–67, 48	1,183	86	966	1,234	88	1,012
Other electrical equipment	361–64, 369	926	81	657	946	84	674
Motor vehicles and other transportation equipment	371, 373–75, 379	1,292	54	1,179	1,331	55	1,214
Aircraft and missiles	372, 19	1,241	31	1,148	1,208	33	1,113
Professional and scientific instruments	38	399	85	200	417	92	212
Scientific and mechanical measuring instruments	381–82	131	(a)	(a)	137	(a)	(a)
Optical, surgical, photographic, and other instruments	383–87	268	(a)	(a)	280	(a)	(a)
Other manufacturing industries	21, 27, 31, 39	350	78	139	360	80	144
Nonmanufacturing industries	07–12, 14–17, 41–47, 49–67, 739, 807, 891	1,219	141	696	1,241	143	718

[a] Not separately available but included in total.

TABLE B-49.—*Total and company funds for R&D performance per employee, by size of company, 1959–69*[a]

Size of company (based on number of employees)	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
	Total R&D funds per employee										
Total	$820	$880	$970	$1,010	$1,110	$1,170	$1,170	$1,160	$1,180	$1,210	$1,250
Less than 1,000	340	330	410	480	520	560	550	620	660	([b])	([b])
1,000 to 4,999	370	440	490	530	580	610	570	550	570	([b])	([b])
5,000 to 9,999	1,030	1,110	1,190	1,200	1,310	1,360	1,360	540	560	690	710
10,000 or more								1,450	1,470	1,450	1,490
	Company R&D funds per employee										
Total	$340	$370	$410	$440	$470	$500	$530	$540	$580	$610	$670
Less than 1,000	([b])	([b])	([b])	320	360	370	370	390	420	([b])	([b])
1,000 to 4,999	240	270	300	320	340	350	350	340	370	([b])	([b])
5,000 to 9,999	400	440	480	490	520	550	590	410	420	470	500
10,000 or more								620	660	690	750

[a] Averages were derived by dividing total and company R&D funds for a calendar year by employment figures for March of that year.

[b] Not separately available but included in total.

TABLE B–50.—*Employees in R&D-performing companies and total and company funds for R&D performance per employee, by industry and selected company size groups, 1969*[a]

Industry and size of company	SIC code	Number employed March 1969 (thousands)	Total R&D funds per employee	Company R&D funds per employee
Total		14,792	$1,250	$670
Distribution by industry				
Food and kindred products	20	829	220	220
Textiles and apparel	22, 23	639	90	([b])
Lumber, wood products, and furniture	24, 25	209	110	110
Paper and allied products	26	489	230	([b])
Chemicals and allied products	28	1,175	1,490	1,330
Industrial chemicals	281–82	721	1,480	1,240
Drugs and medicines	283	213	2,050	([b])
Other chemicals	284–89	241	1,040	([b])
Petroleum refining and extraction	29, 13	627	910	840
Rubber products	30	368	650	530
Stone, clay, and glass products	32	421	450	440
Primary metals	33	1,112	240	230
Ferrous metals and products	331–32, 3391, 3399	757	190	190
Nonferrous metals and products	333–36, 3392	355	350	330
Fabricated metal products	34	523	350	330
Machinery	35	1,569	1,110	860
Electrical equipment and communication	36, 48	2,273	1,890	860
Radio and TV receiving equipment	365	93	1,170	([b])
Communication equipment and electronic components	366–67, 48	1,234	1,990	860
Other electrical equipment	361–64, 369	946	1,830	([b])
Motor vehicles and other transportation equipment	371, 373–75, 379	1,331	1,240	930
Aircraft and missiles	372, 19	1,208	4,800	1,060
Professional and scientific instruments	38	417	1,590	1,080
Scientific and mechanical measuring instruments	381–82	137	640	530
Optical, surgical, photographic, and other instruments	383–87	280	2,060	1,340
Other manufacturing industries	21, 27, 31, 39	360	270	([b])
Nonmanufacturing industries	07–12, 14–17, 41–47, 49–67, 739, 807, 891	1,241	520	160
Distribution by size of company (based on number of employees)				
5,000 to 9,999		1,466	710	500
10,000 or more		10,547	1,480	750

[a] Averages were derived by dividing total and company R&D funds in 1969 by March 1969 employment figures.
[b] Not separately available but included in total.

TABLE B-51.—*Net sales of R&D-performing manufacturing companies, by industry and selected company size groups, 1968 and 1969*

Industry	SIC code	1968			1969		
		Total	Companies with total employment of—		Total	Companies with total employment of—	
			5,000 to 9,999	10,000 or more		5,000 to 9,999	10,000 or more
Total		$418,034	$39,963	$311,828	$445,069	$43,384	$332,438
Food and kindred products	20	39,628	6,612	24,227	42,263	6,877	26,173
Textiles and apparel	22, 23	12,091	(a)	(a)	12,604	(a)	(a)
Lumber, wood products, and furniture	24, 25	5,192	(a)	(a)	5,737	(a)	(a)
Paper and allied products	26	14,303	1,549	10,476	16,451	1,731	12,289
Chemicals and allied products	28	41,314	5,625	28,807	44,155	6,186	30,542
Industrial chemicals	281–82	24,753	612	21,934	26,165	665	23,088
Drugs and medicines	283	6,419	1,847	3,123	7,160	2,133	3,442
Other chemicals	284–89	10,143	3,165	3,750	10,831	3,388	4,012
Petroleum refining and extraction	29, 13	54,321	2,776	50,267	57,331	2,997	52,987
Rubber products	30	10,426	1,011	7,597	11,330	1,148	8,256
Stone, clay, and glass products	32	9,075	1,447	5,468	9,906	1,567	6,067
Primary metals	33	31,202	3,241	22,964	34,169	3,475	25,571
Ferrous metals and products	331–32, 3391, 3399	19,320	(a)	15,444	21,037	(a)	16,915
Nonferrous metals and products	333–36, 3392	11,882	(a)	7,520	13,131	(a)	8,657
Fabricated metal products	34	13,659	1,798	6,118	14,289	1,942	6,471
Machinery	35	37,251	3,287	22,763	40,258	3,819	24,797
Electrical equipment and communication	36, 48	48,549	3,610	37,509	52,600	4,003	40,749
Radio and TV receiving equipment	365	3,114	--------	2,547	3,196	--------	2,650
Communication equipment and electronic components	366–67, 48	23,350	1,703	19,347	26,110	1,824	21,858
Other electrical equipment	361–64, 369	22,086	1,907	15,615	23,293	2,179	16,240
Motor vehicles and other transportation equipment	371, 373–75, 379	47,653	1,735	44,426	49,545	1,950	46,060
Aircraft and missiles	372, 19	30,336	664	28,326	29,992	699	27,924
Professional and scientific instruments	38	10,222	2,026	5,616	11,098	2,239	6,119
Scientific and mechanical measuring instruments	381–82	2,805	(a)	(a)	3,144	(a)	(a)
Optical, surgical, photographic, and other instruments	383–87	7,417	(a)	(a)	7,954	(a)	(a)
Other manufacturing industries	21, 27, 31, 39	12,812	3,120	6,685	13,342	3.216	6,987

[a] Not separately available but included in total.

TABLE B–52.—*Funds for R&D performance as percent of net sales in R&D-performing manufacturing companies, by industry and size of company, 1957–69*

Industry and size of company	SIC code	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
Total		3.4	3.8	3.9	4.2	4.3	4.3	4.5	4.6	4.3	4.2	4.2	4.0	4.0
Distribution by industry														
Food and kindred products	20	.3	.3	.3	.4	.4	.4	.4	.4	.4	.4	.4	.4	.4
Textiles and apparel	22, 23	(a)	.3	.5	.6	.5	.4	.5	.5	.5	.5	.5	.5	.5
Lumber, wood products, and furniture	24, 25	(a)	.4	.5	.6	.5	.5	.5	.5	.4	.4	.3	.4	.4
Paper and allied products	26	.6	.7	.6	.7	.7	.7	.8	.7	.7	.7	.7	.7	.7
Chemicals and allied products	28	3.5	3.8	3.9	4.5	4.3	4.2	4.3	4.5	4.2	4.2	4.3	4.0	4.0
Industrial chemicals	281–82	5.0	5.4	4.8	5.7	5.2	4.9	5.1	5.0	4.6	4.5	4.6	4.1	4.1
Drugs and medicines	283	3.6	4.1	4.2	4.6	4.3	4.3	4.7	5.9	5.7	6.2	6.3	6.1	6.1
Other chemicals	284–89	1.3	1.5	2.0	2.2	2.8	3.0	2.8	2.5	2.3	2.3	2.4	2.3	2.3
Petroleum refining and extraction	29, 13	.7	1.1	1.0	1.0	1.0	1.0	1.0	1.2	1.1	1.0	1.0	1.0	1.0
Rubber products	30	1.7	1.8	2.0	2.0	2.2	2.1	2.3	2.1	2.0	2.0	2.1	2.2	2.1
Stone, clay, and glass products	32	(b)	(b)	(b)	1.6	1.5	1.6	1.6	1.6	1.6	1.6	1.9	1.8	1.9
Primary metals	33	.5	.7	.6	.8	.8	.8	.8	.8	.8	.7	.8	.8	.8
Ferrous metals and products [c]	331–32, 3391, 3399	(a)	.6	.5	.6	.7	.6	.7	.7	.7	.7	.8	.7	.7
Nonferrous metals and products	333–36, 3392	(a)	.7	.9	1.0	1.2	1.1	1.1	1.0	.9	.8	1.0	1.0	.9
Fabricated metal products	34	1.6	1.7	1.4	1.3	1.4	1.5	1.6	1.5	1.3	1.3	1.3	1.3	1.3
Machinery	35	3.4	3.8	4.3	4.7	4.2	4.0	4.2	4.3	4.1	3.9	4.3	4.3	4.3
Electrical equipment and communication	36, 48	7.6	10.3	11.0	11.2	10.1	9.9	10.1	9.8	9.5	8.6	8.6	8.3	8.2
Radio and TV receiving equipment	365	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	2.4	3.0	3.2	3.4
Communication equipment and electronic components	366–67, 48	(a)	11.3	12.6	13.1	12.7	12.8	13.0	13.0	12.3	10.4	10.2	9.9	9.4
Other electrical equipment	361–64, 369	(a)	9.7	9.4	9.1	8.0	7.3	7.3	7.0	7.1	7.4	7.6	7.4	7.4
Motor vehicles and other transportation equipment	371, 373–79	2.9	4.2	2.9	3.0	4.0	3.5	3.4	3.6	3.1	3.2	3.4	3.2	3.3
Aircraft and missiles	372, 19	16.8	17.7	20.7	23.2	23.5	23.8	26.7	28.9	28.1	25.3	21.4	18.7	19.3
Professional and scientific instruments	38	7.0	7.8	7.2	6.3	6.0	6.3	5.9	6.1	6.1	5.6	5.6	5.9	6.0
Scientific and mechanical measuring instruments	381–82	9.5	10.2	9.7	8.6	6.0	5.4	4.1	4.2	3.8	3.3	3.3	3.1	2.8
Optical, surgical, photographic, and other instruments	383–87	5.2	6.3	5.8	5.3	6.1	6.8	6.9	7.0	7.1	6.5	6.5	6.9	7.2
Other manufacturing industries	21, 27, 31, 39	(a)	1.3	.7	.4	.4	.7	.7	.7	.7	.6	.6	.7	.7
Distribution by size of company (based on number of employees)														
Less than 1,000		1.8	1.3	1.7	1.6	1.8	1.8	1.9	2.4	2.1	2.7	1.7	(a)	(a)
1,000 to 4,999		[e]1.8	1.8	1.8	2.2	2.2	2.2	2.4	1.8	2.0	2.3	1.7	(a)	(a)
5,000 to 9,999		[e]3.9	4.8	4.8	5.1	5.2	5.0	5.3	5.3	4.6	1.9	2.1	2.3	2.3
10,000 or more											5.3	5.2	4.7	4.7

---

[a] Not separately available but included in total.

[b] Included in the other manufacturing industries group.

[c] SIC codes 3391 and 3399 included in the nonferrous metals and products group for 1957 to 1965.

[d] Included in the other electrical equipment group.

[e] Separate data for companies with 5,000 or more employees and for companies with 1,000 to 4,999 employees were estimated by the National Science Foundation for 1957. Revisions of R&D statistics by the U.S. Bureau of the Census for this year did not yield separate data for companies in these size groups.

TABLE B-53.—*Company funds for R&D performance as percent of net sales in R&D-performing manufacturing companies, by industry and size of company, 1957–69*

Industry and size of company	SIC code	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
Total		1.5	1.6	1.6	1.8	1.8	1.9	1.9	2.0	2.0	2.0	2.1	2.1	2.2
Distribution by industry														
Food and kindred products	20	.3	.3	.3	.3	.3	.3	(a)	(a)	.4	.4	.4	.4	.4
Textiles and apparel	22, 23	(a)	.2	.3	.4	(a)	(a)	.4	.4	.4	(a)	(a)	(a)	(a)
Lumber, wood products, and furniture	24, 25	(a)	.4	.4	.5	(a)	(a)	(a)	(a)	(a)	.4	.3	.4	.4
Paper and allied products	26	.6	.7	.6	(a)	(a)	.7	.8	.7	.7	(a)	(a)	(a)	(a)
Chemicals and allied products	28	3.1	3.2	3.2	3.7	3.5	3.4	3.6	3.8	3.6	3.7	3.8	3.5	3.5
Industrial chemicals	281–82	4.2	4.3	3.9	4.7	4.2	4.0	4.1	4.2	3.9	3.7	3.7	3.4	3.4
Drugs and medicines	283	3.6	4.0	4.2	4.5	4.2	4.2	4.5	5.6	5.4	(a)	(a)	(a)	(a)
Other chemicals	284–89	1.2	1.3	1.5	1.6	1.6	1.8	1.8	1.9	2.0	(a)	(a)	(a)	(a)
Petroleum refining and extraction	29, 13	.7	1.1	.9	1.0	1.0	.9	1.2	1.0	.9	.9	.9	.9	.9
Rubber products	30	1.1	1.4	1.3	1.3	1.5	1.6	1.6	1.0	1.7	1.7	1.8	1.8	1.7
Stone, clay, and glass products	32	(b)	(b)	(b)	(b)	1.4	1.5	1.6	1.6	1.6	1.5	1.8	1.7	1.9
Primary metals	33	.5	.6	.6	.7	.8	.7	.7	.7	.7	.7	.8	.8	.8
Ferrous metals and products [c]	331–32, 3391, 3399	(a)	.6	.5	.6	.7	.6	.7	.6	.7	.7	.7	.7	.7
Nonferrous metals and products	333–36, 3392	(a)	.6	.8	.9	1.0	.9	.9	.9	.9	.8	.9	.9	.9
Fabricated metal products	34	1.1	1.1	1.0	1.0	1.0	1.3	1.4	1.3	1.2	1.1	1.2	1.2	1.2
Machinery	35	2.0	2.1	2.4	2.7	2.7	2.9	3.1	3.2	3.1	3.0	3.2	3.2	3.4
Electrical equipment and communication	36, 48	2.6	3.3	3.2	3.8	3.6	3.5	3.6	3.6	3.6	3.4	3.5	3.6	3.7
Radio and TV receiving equipment	365	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(a)	(a)	(a)	(a)
Communication equipment and electronic components	366–67, 48	(a)	3.3	3.3	3.8	4.3	4.2	4.2	4.3	4.4	3.9	4.1	4.1	4.1
Other electrical equipment	361–64, 369	(a)	3.3	3.1	3.5	3.1	3.0	3.0	3.1	3.0	(a)	(a)	(a)	(a)
Motor vehicles and other transportation equipment	371, 373–79	2.1	2.8	2.5	2.3	3.0	2.5	2.5	2.6	2.3	2.4	2.5	2.3	2.5
Aircraft and missiles	372, 19	2.0	2.3	2.2	2.4	2.4	2.7	2.6	2.5	3.4	3.5	4.1	3.8	4.3
Professional and scientific instruments	38	3.9	4.1	3.8	3.4	3.7	4.1	4.2	4.3	4.1	3.8	3.6	3.8	4.0
Scientific and mechanical measuring instruments	381–82	4.0	4.0	3.8	3.4	3.0	3.4	3.1	3.1	2.9	2.7	2.4	2.5	2.3
Optical, surgical, photographic, and other instruments	383–87	3.8	4.1	3.9	3.6	4.1	4.5	4.8	4.9	4.6	4.3	4.1	4.3	4.7
Other manufacturing industries	21, 27, 31, 39	(a)	(a)	(a)	(a)	.5	.6	.6	.6	.7	(a)	(a)	(a)	(a)
Distribution by size of company (based on number of employees)														
Less than 1,000		1.4	.7	(a)	(a)	(a)	(a)	1.5	1.4	1.7	1.4	1.6	(a)	(a)
1,000 to 4,999		[e] 1.2	1.3	1.2	1.4	1.5	1.5	1.5	1.6	2.1	1.3	1.4	(a)	(a)
5,000 to 9,999		[e] 1.6	1.9	1.9	2.0	2.1	2.0	2.1	2.1	2.1	1.5	1.6	1.6	1.7
10,000 or more											2.2	2.3	2.3	2.4

---

[a] Not separately available but included in total.

[b] Data included in the other manufacturing industries group.

[c] SIC codes 3391 and 3399 included in the nonferrous metals and products group for 1957 to 1965.

[d] Included in the other electrical equipment group.

[e] Estimated by the National Science Foundation.

TABLE B-54.—*Funds for R&D performance as percent of net sales in R&D-performing manufacturing companies, by industry and selected company size groups, 1969*

Industry	SIC code	Total	Companies with total employment of—	
			5,000 to 9,999	10,000 or more
Total	------------------	4.0	2.3	4.7
Food and kindred products	20	.4	.3	.5
Textiles and apparel	22, 23	.5	(a)	(a)
Lumber, wood products, and furniture	24, 25	.4	(a)	(a)
Paper and allied products	26	.7	.6	.7
Chemicals and allied products	28	4.0	3.8	4.1
Industrial chemicals	281–82	4.1	1.5	4.2
Drugs and medicines	283	6.1	7.9	5.1
Other chemicals	284–89	2.3	1.7	2.8
Petroleum refining and extraction	29, 13	1.0	.7	1.0
Rubber products	30	2.1	3.0	2.1
Stone, clay, and glass products	32	1.9	1.1	2.5
Primary metals	33	.8	.6	.8
Ferrous metals and products	331–32, 3391, 3399	.7	(a)	.7
Nonferrous metals and products	333–36, 3392	.9	(a)	.9
Fabricated metal products	34	1.3	1.3	1.5
Machinery	35	4.3	2.0	6.0
Electrical equipment and communication	36, 48	8.2	6.0	9.2
Radio and TV receiving equipment	365	3.4	--------	3.8
Communication equipment and electronic components	366–67, 48	9.4	(a)	(a)
Other electrical equipment	361–64, 369	7.4	(a)	(a)
Motor vehicles and other transportation equipment	371, 373–75, 379	3.3	.9	3.5
Aircraft and missiles	372, 19	19.3	8.9	20.3
Professional and scientific instruments	38	6.0	8.3	6.5
Other manufacturing industries	21, 27, 31, 39	.7	.6	.7

---

[a] Not separately available but included in total.

TABLE B-55.—*Company funds for R&D performance as percent of net sales in R&D-performing manufacturing companies, by industry and selected company size groups, 1969*

Industry	SIC code	Total	Companies with total employment of—	
			5,000 to 9,999	10,000 or more
Total		2.2	1.7	2.4
Food and kindred products	20	.4	(a)	(a)
Textiles and apparel	22, 23	(a)	(a)	(a)
Lumber, wood products, and furniture	24, 25	.4	(a)	(a)
Paper and allied products	26	(a)	(a)	(a)
Chemicals and allied products	28	3.5	3.7	3.5
Petroleum refining and extraction	29, 13	.9	.7	.9
Rubber products	30	1.7	(a)	1.9
Stone, clay, and glass products	32	1.9	(a)	(a)
Primary metals	33	.8	.6	.7
Fabricated metal products	34	1.2	(a)	1.3
Machinery	35	3.4	(a)	4.4
Electrical equipment and communication	36, 48	3.7	(a)	4.0
Radio and TV receiving equipment	365	(a)		(a)
Communication equipment and electronic components	366-67, 48	4.1	(a)	(a)
Other electrical equipment	361-64, 369	(a)	(a)	(a)
Motor vehicles and other transportation equipment	371, 373-75, 379	2.5	.6	2.6
Aircraft and missiles	372, 19	4.3	3.2	4.4
Professional and scientific instruments	38	4.0	4.0	4.7
Other manufacturing industries	21, 27, 31, 39	(a)	(a)	(a)

[a] Not separately available but included in total.

TABLE B-56.—*Funds for R&D performance as percent of net sales in manufacturing companies with the largest R&D programs, by industry, 1969*

Industry	SIC code	First 4 companies	First 8 companies	First 20 companies
Total		10.4	12.9	11.7
Food and kindred products	20	.9	.7	.6
Textiles and apparel	22, 23	.5	.6	.6
Lumber, wood products, and furniture	24, 25	.3	.4	.3
Paper and allied products	26	.9	.8	.8
Chemicals and allied products	28	6.3	6.3	5.5
Industrial chemicals	281-82	6.3	5.9	4.5
Drugs and medicines	283	12.3	7.6	6.3
Other chemicals	284-89	2.8	2.8	2.5
Petroleum refining and extraction	29, 13	1.7	1.2	1.0
Rubber products	30	2.3	2.4	2.2
Stone, clay, and glass products	32	3.3	2.9	2.2
Primary metals	33	.9	.9	.9
Ferrous metals and products	331-32, 3391, 3399	.8	.8	.7
Nonferrous metals and products	333-36, 3392	1.1	1.3	1.1
Fabricated metal products	34	1.6	1.7	1.6
Machinery	35	11.7	9.7	7.4
Electrical equipment and communication	36, 48	12.4	11.5	10.9
Radio and TV receiving equipment	365	4.2	3.5	(a)
Communication equipment and electronic components	366-67, 48	11.3	11.1	10.6
Other electrical equipment	361-64, 369	11.6	11.7	9.4
Motor vehicles and other transportation equipment	371, 373-75, 379	3.8	3.7	3.5
Aircraft and missiles	372, 19	29.5	29.4	20.7
Professional and scientific instruments	38	11.9	9.6	7.4
Scientific and mechanical measuring instruments	381-82	2.8	2.8	2.9
Optical, surgical, photographic, and other instruments	383-87	11.9	9.4	7.9
Other manufacturing industries	21, 27, 31, 39	.9	.8	.8

[a] Less than 20 companies.

Appendix C

COVERING LETTERS, QUESTIONNAIRE, AND INSTRUCTIONS

Page

National Science Foundation covering letter 86
Bureau of the Census covering letter 87
Form RD-1 88
Attachment to Form RD-1 90
Instructions (Form RD-1) 91
RD-1 Supplementary Instructions Sheet, 1969 99

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

NSF-L1
(1969)

Gentlemen:

The basic statute of the National Science Foundation directs it to collect and analyze information on the scientific resources of the Nation. The annual survey of industrial research and development is part of the Foundation's continuing program which measures these resources. Similar surveys are conducted in the Federal Government, universities and colleges, and nonprofit organizations. We will greatly appreciate your cooperation in completing the enclosed questionnaire.

Data obtained in the industry surveys assist Government officials in formulating policies and programs to strengthen science and technology. They also permit company administrators to compare their R&D programs with those of other firms and industries.

As in previous years, the U.S. Bureau of the Census will collect and compile the survey responses for the Foundation.

We appreciate your past and continuing participation in this survey. We will be pleased to send your company a copy of the published report upon request.

Sincerely yours,

Charles E Falk

Charles E. Falk
Planning Director

Enclosures

RD-1-L1
(1969)

U.S. DEPARTMENT OF COMMERCE
Bureau of the Census
Washington, D.C. 20233

OFFICE OF THE DIRECTOR

Gentlemen:

Enclosed are copies of Form RD-1, "Survey of Industrial Research and Development During 1969"; a letter from the National Science Foundation which sponsors this survey, emphasizing the importance of the data; and an instruction manual to assist you in completing your report. Your 1969 report on Form RD-1 should cover your entire company, unless otherwise designated.

Your report to the Census Bureau is confidential by law (Title 13, United States Code, Section 9). It may be seen only by sworn Census employees and may be used only for statistical purposes. The law also provides that copies retained in your files are immune from legal process.

If you have any questions regarding this report, please write to the Industry Division, Bureau of the Census, Washington, D. C. 20233.

Sincerely,

George H. Brown

GEORGE H. BROWN
Director
Bureau of the Census

Enclosures

DUE DATE: 30 DAYS AFTER RECEIPT OF FORM Budget Bureau No. 41-R1883; Approval Expires December 31, 1970

FORM RD-1
(11-24-69)
U.S. DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS
COLLECTING AND COMPILING AGENT FOR
THE NATIONAL SCIENCE FOUNDATION

SURVEY OF INDUSTRIAL RESEARCH AND DEVELOPMENT DURING 1969

TO: Bureau of the Census
Jeffersonville, Indiana 47130

NOTICE – Your report to the Census Bureau is confidential by law (Title 13, U.S. Code). It may be seen only by sworn Census employees and may be used only for statistical purposes. The law also provides that copies retained in your files are immune from legal process.

ITEM 1 – NAME AND ADDRESS OF COMPANY *(Please correct any error in name and address including ZIP code)*

Group	Survey
4	4001

(PLEASE RETURN THIS COPY)

GENERAL INSTRUCTIONS

- Please complete and return this form in the envelope provided within 30 days. Retain the file copy for your records. This report should cover your entire company, including all subsidiaries and affiliates, unless otherwise designated.
- Enter "None" where appropriate, rather than leaving a blank space.
- Reasonably accurate estimates are acceptable.
- Be sure 1968 and 1969 figures are comparable.

PLEASE READ ENCLOSED INSTRUCTIONS BEFORE COMPLETING THIS FORM.

Data supplied in item 2 and in item 5C, columns 2 and 4, for 1969 on this form will satisfy the mandatory reporting requirement of Census form MA-121 (Title 13 U.S. Code).

CENSUS USE ONLY	1	2	3	4	5	6

Name of person who supplied 1968 data

Section I – GENERAL COMPANY DATA

ITEM		C.T. 1	1968 [1]	1969 [2]
2	**A.** Net sales and receipts of this company *(Thousands of dollars)*	2001	$	$
	B. Total company employment in all activities during the pay period which includes the 12th of March, 1968 and 1969	2002		

ITEM 3 **Are research and development expenditures for entire company, including subsidiaries and affiliates, reported on this form?** . . . . ☐ Yes ☐ No
If "No," please explain in Remarks or transmittal letter.

Section II – RESEARCH AND DEVELOPMENT PERFORMED WITHIN THE COMPANY IN THE UNITED STATES

(Exclude R and D financed by the company but performed by others. Report such R and D in section III.)

ITEM	NUMBER OF RESEARCH AND DEVELOPMENT SCIENTISTS AND ENGINEERS *(See instructions)*	C.T. 2	January 1969 [1]	January 1970 [2]	Man-years for 1969* [3]
4	**A.** Federal research and development	3001			
	B. Company and other research and development	3002			
	C. **TOTAL NUMBER** *(Sum of A and B)* ⟶	3099			

*For companies in which the number of research and development scientists and engineers did not change significantly during 1969, the average of columns 1 and 2 will supply an acceptable estimate for column 3. Other companies may use the average of quarterly or monthly employment figures.

ITEM	COST OR RECEIPTS FOR RESEARCH AND DEVELOPMENT PERFORMED WITHIN THE COMPANY BY MAJOR TYPE AND SOURCE OF FUNDS		C.T. 2	Thousands of dollars			
				1968	1969		
				TOTAL [1]	Federal funds [2]	Company and other funds, except Federal [3]	TOTAL (Sum of columns 2 and 3) [4]
5	**A.** Basic research		3510	$	$	$	$
Please complete 5E also	**B.** Applied research and development	1. Applied research	3521				
		2. Development	3522				
		3. **Total** *(Sum of lines 1 and 2)*	3529				
	C. **TOTALS** *(Sum of A and B3)* ⟶		3599	$	$	$	$
	D. **1968 TOTALS** ⟶				$	$	$
	E. **Company and other funds, except Federal budgeted for the year 1970** ⟶		C.T. 1 3800			$	▨

ITEM	COMPANY RESEARCH AND DEVELOPMENT ALLOWED AS INDIRECT COSTS OF FEDERAL CONTRACTS	C.T. 1	Thousands of dollars	
			1968 [1]	1969 [2]
6	**Approximately what amount of the total reported in item 5C, column 3, was allowed as indirect costs of Federal contracts?** (In accordance with ASPR Regulation 15,205 and the same regulation as used in NASA and other Federal contracts.)	3900	$	$

ITEM	COST OR CONTRACT VALUE OF RESEARCH AND DEVELOPMENT PERFORMED WITHIN THIS COMPANY BY MAJOR TYPE OF EXPENSE		[1]	[2]
7	**A.** Wages and salaries of research and development scientists and engineers	4010	$	$
	B. Wages and salaries of all supporting personnel (include technicians, secretaries, and other personnel)	4020		
	C. Costs of materials and supplies consumed (do not include in this item components, models, and other materials supplied by other research organizations)	4030		
	D. Other costs (include service and supporting costs, depreciation, and share of overhead)	4040		
	E. **TOTAL COSTS** *(Sum of A through D) (Same as item 5C, columns 1 and 4)*	4099	$	$

ITEM	FIELDS OF BASIC RESEARCH (Of the total reported in item 5A for basic research, please give cost for the following fields.)		[1]	[2]
8	1. Chemistry	5001	$	$
	2. Engineering (including Metallurgy)	5002		
	3. Geological sciences	5003		
	4. Mathematics	5004		
	5. Physics	5005		
	6. Astronomy	5006		
	7. Atmospheric sciences	5007		
	8. Oceanography	5008		
	9. Biological sciences	5009		
	10. Clinical medical sciences	5010		
	11. Other sciences	5011		
	12. **TOTAL BASIC RESEARCH COSTS** *(Same as item 5A, columns 1 and 4)*	5099	$	$

Please complete form and sign certification on reverse side.

USCOMM-DC

Section II – RESEARCH AND DEVELOPMENT PERFORMED WITHIN THE COMPANY IN THE UNITED STATES – Continued
(Exclude R and D financed by the company but performed by others. Report such R and D in section III.)

ITEM 9	APPLIED RESEARCH AND DEVELOPMENT BY PRODUCT GROUP (Of the total reported in item 5B, line 3, for applied research and development, please give cost of project for each of the following.)	C.T. 2	*Thousands of dollars* 1968 Federal 1	1968 Total 2	1969 Federal 3	1969 Total 4
	1. Atomic energy devices *(See Instruction Manual, page 6)*					
	2. Food and kindred products	6200	$	$	$	$
	3. Textile mill products	6220				
	4. Industrial inorganic and organic chemicals	6281				
	5. Plastics materials and synthetic resins, rubber, and fibers	6282				
	6. Drugs	6283				
	7. Agricultural chemicals	6287				
	8. All other chemicals	6289				
	9. Petroleum refining and extraction	6290				
	10. Rubber and miscellaneous plastics products	6300				
	11. Stone, clay, glass, and concrete products	6320				
	12. Primary ferrous products	6331				
	13. Primary and secondary nonferrous metals	6339				
	14. Fabricated metal products	6340				
	15. Engines and turbines	6351				
	16. Farm machinery and equipment	6352				
	17. Construction, mining, and materials handling machinery	6353				
	18. Metalworking machinery and equipment	6354				
	19. Office, computing and accounting machines	6357				
	20. Other machinery, except electrical	6359				
	21. Electric transmission and distribution equipment	6361				
	22. Electrical industrial apparatus	6362				
	23. Radio and television receiving sets, except communication types	6365				
	24. Electronic components and accessories, communications equipment	6366				
	25. Other electrical machinery equipment and supplies	6369				
	26. Missiles	6197				
	27. Space vehicles	6198				
	28. Aircraft and parts	6372				
	29. Motor vehicles and equipment	6371				
	30. Other transportation equipment	6379				
	31. Professional and scientific instruments	6380				
	32. Ordnance, except missiles	6199				
	33. Other *(Specify)*	6998				
	34. **TOTAL APPLIED RESEARCH AND DEVELOPMENT COSTS** *(Same as item 5B, line 3, columns 1, 2 and 4)*	6999	$	$	$	$

ITEM 10 **COST OF RESEARCH AND DEVELOPMENT PERFORMED WITHIN THE COMPANY, BY STATE**

Were all of the research and development costs reported in item 5C, column 4, for 1969 performed in the State listed in the address block (item 1) of this form? . . . . ☐ Yes ☐ No

If "No," list the home State and any other States in which the various R and D laboratories or facilities are located, and estimate the costs associated with each State. If desirable, report up to 10 percent of your total as "Not distributed by State."

State *(Attach additional sheet if necessary)*	C.T. 1	*Thousands of dollars* 1968 1	1969 2
A.	71	$	$
B.	71		
C.	71		
D.	71		
E.	71		
F.	71		
G. **TOTAL COSTS** *(Same as item 5C, columns 1 and 4)* →	7199	$	$

Section III – RESEARCH AND DEVELOPMENT PERFORMED OUTSIDE THE DOMESTIC COMPANY WITH COMPANY FUNDS

ITEM 11		C.T. 1	*Thousands of dollars* 1968 1	1969 2
	TOTAL COMPANY FUNDS SPENT FOR RESEARCH AND DEVELOPMENT ACTIVITIES PERFORMED OUTSIDE THE COMPANY WITHIN THE UNITED STATES →	8001	$	$

Remarks *(Attach additional sheet if necessary)*

Name of person to contact regarding this report	Address *(Number and street, city, State, ZIP code)*	Telephone *(Area code, number, extension)*

CERTIFICATION – This report is substantially accurate and has been prepared in accordance with instructions.

Name of company	Address *(Number and street, city, State, ZIP code)*	
Signature of authorized official	Title	Date

FORM RD-1 (11-24-69) USCOMM-DC

DUE DATE: 30 DAYS AFTER RECEIPT OF FORM Budget Bureau No. 41-R1883; Approval Expires December 31, 1970

NOTICE - Your report to the Census Bureau is confidential by law (Title 13, U.S. Code). It may be seen only by sworn Census employees and may be used only for statistical purposes. The law also provides that copies retained in your files are immune from legal process.

FORM **RD-11**
(11-26-69)

U.S. DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS
COLLECTING AND COMPILING AGENT FOR
THE NATIONAL SCIENCE FOUNDATION

ATTACHMENT TO FORM RD-1

SURVEY OF INDUSTRIAL RESEARCH AND DEVELOPMENT DURING 1969

Complete this attachment and return it with the COMPLETED form RD-1 to the Bureau of the Census, Jeffersonville, Indiana, 47130.

ITEM 1 – Name and address of company *(Please correct if any error in name and address including ZIP code*

Group	Survey
4	4001

(PLEASE RETURN THIS COPY)

CENSUS USE ONLY →	1	2	3	4	5	6

The following supplementary information is requested from you as one of the companies with the largest research and development programs:

Breakdown of items 4 and 5 of Form RD-1 – Companies reporting Federal research and development of more than $1 million are asked to provide separate figures for the three categories of Federal agencies: Department of Defense, National Aeronautics and Space Administration, and all other Federal agencies. In general, most companies performing large amounts of research and development for the Government will have one or more separate organizational units charged with the responsibility for most Federal contracts. Reporting of the requested data has been simplified for some companies by using the data available from the accounts of such units as the basis for the overall company figures on the number of scientists and engineers and the costs of Federal programs. For example; if 80 percent of the work for Federal agencies is performed by units with separate accounts, it should be reasonable to estimate the company totals on the basis of such figures rather than make special tabulations or separate estimates for each of the company units that may be doing some work on Government research and development.

In part A below, please distribute the research and development scientists and engineer man-years (Item 4A, column 3 of Form RD-1) according to the share of research and development time devoted to each program.

In part B below, please distribute the costs of the research and development work (Item 5C, column 2 of Form RD-1) by Federal agency.

Item 10 for companies with the largest research and development programs – Companies with the largest research and development programs are being asked to report here the breakdown, by State, of Federal as well as total research and development. For such companies, Item 10 on Form RD-1 will be left blank.

ITEMS 4 AND 5 *(Breakdown)* – **RESEARCH AND DEVELOPMENT INFORMATION BY PRINCIPAL FEDERAL AGENCY**

A. Research and development scientist and engineer man-years *(Breakdown of item 4A, column 3, of RD-1)*	C.T. 1	Man-years for 1968 (1)	Man-years for 1969 (2)
1. Department of Defense	3601		
2. National Aeronautics and Space Administration	3602		
3. All other Federal Agencies	3603		
4. **TOTAL FEDERAL SCIENTISTS AND ENGINEERS** →	3699		

B. Cost of Federal research and development during 1969 *(Breakdown of item 5C, column 2, of RD-1)*	C.T. 1	*Thousands of dollars* 1968 (1)	1969 (2)
1. Department of Defense	3701	$	$
2. National Aeronautics and Space Administration	3702		
3. All other Federal Agencies	3703		
4. **TOTAL FEDERAL RESEARCH AND DEVELOPMENT** →	3799	$	$

ITEM 10 **COSTS OF RESEARCH AND DEVELOPMENT PERFORMED WITHIN THE COMPANY BY STATE**

Were all of the research and development costs reported in item 5C, column 4, on Form RD-1 for 1969 performed in the State listed in the address block (item 1) of this form? . . . . ☐ Yes ☐ No

If "No," list the home State and any other States in which the various research and development laboratories or facilities are located, and estimate the costs associated with each State. If desirable, report up to 10 percent of your total as "Not distributed by State."

State *(Attach an additional sheet if necessary)*	C.T. 1	**Research and development** *(Thousands of dollars)* 1968 Federal (1)	1968 Total (2)	1969 Federal (3)	1969 Total (4)
A.	71	$	$	$	$
B.	71				
C.	71				
D.	71				
E.	71				
F.	71				
G.	71				
H.	71				
I.	71				
J.	71				
K.	71				
L.	71				
M.	71				
N.	71				
O.	71				
P. TOTAL COSTS → *(Same as item 5C, Form RD-1)*	7199	$	$	$	$

Use reverse side for remarks

USCOMM-DC

FORM RD-1
(Instruction Manual)

U.S. DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS
COLLECTING AND COMPILING AGENT FOR
THE NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20233

INSTRUCTIONS FOR SURVEY OF INDUSTRIAL RESEARCH AND DEVELOPMENT DURING 1969

GENERAL

Outline of instructions	Page
Information about reporting: Additional forms	1
Companies new to survey	1
Preposted figures	1
Revision of figures	2
Coverage-reported unit, period, Geographic area	2
Section I – GENERAL COMPANY DATA	2
Item 2 – Sales and Employment for Company	2
DEFINITION OF RESEARCH AND DEVELOPMENT	2
Section II – RESEARCH AND DEVELOPMENT PERFORMED WITHIN THE COMPANY IN THE UNITED STATES	3
Item 4 – Number of Research and Development Scientists and Engineers	3
Costs of Research and Development – Inclusions, Exclusions	3
Cost or Receipts for Research and Development Performed Within the Company by Major Type and Source of Funds	3
Type of Research	4
Item 5A – Basic Research	4
Item 5B1 – Applied Research	4
Item 5B2 – Development	4
Methods of Estimating Research and Development By Major Type	4
Source of Funds	5
Item 5 – Column 2, Federal	5
Item 5 – Column 3, Company and Other Except Federal	5
Item 5E – Funds budgeted for 1970	5
Item 6 – Company Research and Development as Indirect Cost of Federal Contracts	5
Item 7 – Cost of Research and Development by Major Type of Expense	5
Item 8 – Fields of Basic Research	5
Item 9 – Applied Research and Development by Product Group	5
Item 10 – Costs of Research and Development Performed Within the Company, by State	8
Section III – REPORTING OF RESEARCH AND DEVELOPMENT PERFORMED OUTSIDE OF COMPANY WITH COMPANY FUNDS	8
Item 11 – Total Company Funds Spent for Research and Development Activities Performed Outside the Company Within the United States	8

GENERAL

Information about Reporting: Additional Forms – Reporting on this form may require that companies resort to the use of estimates in answering some of the questions. We are satisfied, however, that the comparability of data among companies with research and development programs is sufficient to develop meaningful totals and measures of changes from year to year.

If you require additional copies of the form, write to the Bureau of the Census, Jeffersonville, Indiana 47130. If you have any questions regarding reporting on this form, write to the Bureau of the Census, Washington, D.C. 20233.

Companies Reporting in Survey for the First Time – Companies not reporting in 1968 Survey should fill in the figures for both years. If the company had no expenditures for research and development, complete only "Item 2." Enter "No R & D" in the space for remarks on page 2 of the form, sign and return the form.

Figures for Earlier Years are Preposted on the Form - If your company reported on Form RD-1 for 1968, certain figures from that form have been copied to the present form. Please describe in the "Remarks" section (page 2 of the form) the reasons for any substantial increases or decreases in the 1969 figures entered on this form when compared to corresponding 1968 figures. Examples of such reasons are new government contracts, acquisitions and disposals, revised accounting method, etc. If you acquired or disposed of a unit performing an important amount of research and development during the two-year period, please identify the unit in remarks, and give the total amount of research and development accounted for by such unit.

Revision of Earlier Year Figures – The 1968 figures should be revised if necessary to assure comparability with 1969 data. Please explain in remarks, any significant change in the 1968 figures. If your company did not report for 1968 or no entries have been entered in the 1968 column, fill in the figures for both years.

Report for Your Entire Company – Research and development activities for your entire company should be reported, including all subsidiaries and divisions of the company. If you desire to have subsidiaries report separately, please write to the Census Bureau and list your subsidiaries.

Period Covered by Report – The figures reported should cover the calendar year if at all possible. However, fiscal year data are acceptable for all items except employment, provided your fiscal year ends between September and March. Please report employment figures (Items 2B and 4) for the period identified in each of the items mentioned.

Geographic Area Covered – The data are intended to relate to business firms in the fields of manufacturing, minerals and other economic areas which operate one or more establishments in one or more of the 50 States or the District of Columbia.

Section 1 – GENERAL COMPANY DATA

Item 2 – Sales and Employment for Company – In Item 2A, report the net sales and receipts of this company and its subsidiaries to customers outside the company. (Exclude domestic intra-company transfers and sales by foreign subsidiaries. Include transfers to such foreign subsidiaries, however.) The reported figures should represent value f.o.b. plant after discounts and allowances and should not include freight charges; excise taxes should be included. In Item 2B report the number of persons employed at the company in all activities in the 50 States or the District of Columbia during the pay period which includes the 12th of March, 1968 and 1969. This figure would be the same as that shown by the company in Item 14 of Treasury Form 941, if the company filed one Form 941 for the entire company.

DEFINITION OF RESEARCH AND DEVELOPMENT

Research and development includes basic and applied research in the sciences and in engineering, and design and development of prototypes and processes. For the purposes of this questionnaire, research and development includes activities carried on by persons trained, either formally or by experience, in the physical sciences including related engineering, and the biological sciences including medicine but excluding psychology, if the purpose of such activity is to do one or more of the following things:

1. Pursue a planned search for new knowledge, whether or not the search has reference to a specific application.

2. Apply existing knowledge to problems involved in the creation of a new product or process, including work required to evaluate possible uses.

3. Apply existing knowledge to problems involved in the improvement of a present product or process.

Research and development includes the activities described above whether assigned to separate research and development organizational units of the company or carried on by company laboratories and technical groups not part of a research and development organization. We recognize that the reporting activities of such latter groups will require the use of estimates for some of the questions.

Activities to be Excluded from Research and Development – Research and development for purposes of this survey does not include quality control, routine product testing, market research, sales promotion, sales service, research in the social sciences or psychology, or other nontechnological activities or technical services.

More specifically, exclude from research and development such nontechnological activities as market research, including statistical surveys of product acceptance, estimates of market size, and studies of channels of distribution; and market development, including the sale of either old or new products to obtain acceptance of them in new outlets; economic research and other research in the social sciences; and legal work in connection with patent applications and litigation, and the sale or licensing of patents.

Also exclude from research and development such technical services as: quality and quantity control tests and analyses, trouble-shooting in connection with breakdowns in full-scale production, including related analytical work; technical plant sanitation control; work required for minor adaptations of a specific product to meet the requirements of a specific customer, including installation and servicing in a customer's plant; engineering and other technical service furnished in accordance with agreements to licensees outside the company; aid furnished by the research and development organization to manufacturing divisions to enable them to operate in accordance with previously determined formulas, standard practice instructions, or finished product specifications; aid furnished to develop advertising programs and to promote or demonstrate new products or processes, including the cost of material furnished for trial or demonstration; assistance in preparation of speeches and publications for persons not engaged in research and development; and experimental work performed at the request of the patent division to provide information needed during the prosecution of a patent litigation.

Section II – RESEARCH AND DEVELOPMENT PERFORMED WITHIN THE COMPANY, IN THE UNITED STATES

Item 4 – Research and Development Scientists and Engineers – Scientists and engineers for this survey are defined as all persons engaged in scientific or engineering work at a level which requires a knowledge of physical or life sciences or engineering or mathematics equivalent at least to that acquired through completion of a four-year college course with a major in these fields, regardless of whether they held a college degree in the field.

As in the past, the figure on R&D scientists and engineers will be obtained primarily from two sources:

1. Records on the number of scientists and engineers assigned to research and development. This source is satisfactory so long as the scientists and engineers of the unit are assigned to research and development on a full-time basis (i.e., no more than 5 percent of their time is spent on non-research and development). For example, for company laboratories performing only research and development, report the number of scientists and engineers on the rolls in January. For other units, use Source 2.

2. Figures on the proportion of total work time of scientists and engineers that is devoted to research and development. For example, if the engineering department of a manufacturing plant had 60 scientists and engineers in January 1970 and one-fourth of the scientists' and engineers' time during that month was charged to research and development projects, the figure for the number of research and development scientists and engineers included for that unit would be 15.

Estimates of Man Years – Each of the above 2 methods yields an estimate of man-months (for the month of January). If the average of the two January figures is representative of the entire year, the average should be entered in item 4C, column 3, as an estimate of man-years. Otherwise, the figure in column 3 should be estimated separately on the basis of quarterly, monthly, or other time records. Total man-years of research and development scientists' and engineers' time is the same as the average number of scientists and engineers working during the year.

Separate figures are requested on the number of scientists and engineers working on Federal and company and other research and development projects. Where research and development work for the Government and for the company is performed by the same group of scientists and engineers, it will be necessary to distribute the total number of such scientists and engineers according to the program, Federal or company, for which the research and development work was performed; i.e. to use the proportion of the total work time of research and development scientists and engineers that is devoted to Federal and company research and development programs, in order to distribute the total reported in item 4C. The resulting figures should be reported to the nearest man-year, in order to present a reasonable division of time assigned to Federal and company and other research and development programs.

Please divide the requested figures into the related cost figures and check the resulting cost figure of research and development per scientist and engineer for reasonableness.

Cost or Receipts for Research and Development Performed Within the Company by Major Type and Source of Funds – Include all costs incurred to support research and development, exclusive of capital expenditures, but including depreciation and overhead. If you perform research and development for others on contract, include the total charged for the work performed, including profit.

The relevant costs usually include but are not limited to the elements listed below:

1. Wages, salaries, and related costs. Material and supplies consumed (or purchased, if consumption figures are not available); utilities, such as telephone, telegraph, electricity, water, gas, and fuel; books and periodicals; travel and entertainment costs and professional dues.

2. Property taxes and other taxes (except income taxes) incurred on account of the research and development organization or on the facilities which the research and development organization uses. Insurance expense. Maintenance and repair, including the maintenance of buildings and grounds, depreciation on buildings, equipment, and vehicles; or rentals, if any facilities are leased.

3. Company overhead. Estimate a fair share of the cost of any functions which support research and development activities. The basis and method of estimating overhead costs will depend upon company practice. The important point is to be sure that all companies include an allowance for overhead. Items normally covered in overhead include the following:

Personnel, including personnel, medical and safety departments, and employee or industrial relations department; accounting control and fiscal (Treasurer's office); procurement and inventory, including purchasing, receiving, inspection, storage, transportation, control, and issue of materials and supplies; other services, including legal, public relations, shopwork, analytical work, plant protection, rearrangement of facilities, drafting, printing, duplicating, transportation of material and personnel, maintenance of motor vehicles, messenger service, stenographic service, and photography; salaries and related costs of research executives not on the payroll of the research and development organization.

Do not net your research and development expenditures by the amount of royalties received from either noncompany organizations or company units; or the credits received for research and development work charged or "sold" to other departments or divisions of reporting company or to outside organizations.

Types of Expense to be excluded from Research and Development Costs – Exclude from the cost of research and development performed within the company the cost of research and development carried on for the company by noncompany research and development organizations of any kind; or fellowships, grants, and gifts to promote research and development or the study of the sciences and engineering. That part of company held research and development contracts subcontracted to research and development organizations outside reporting company. All work that was done for your laboratories and other technical units by noncompany organizations which are not research and development organizations (for example, model construction by a noncompany model shop) is to be considered as a purchase of equipment, material, or supplies for the company research organization rather than as subcontracted research and development.

Capital expenditures, royalties paid, patent expense, income taxes, or interest. Income from sale of products manufactured in the research and development organization if these were sold to bona fide customers.

Item 5 – Research and Development Performed Within the Company by Type and by Source of Funds.

This item provides separate columns for reporting in 1969 the costs of research and development in Federal contracts and subcontracts, and Company and Other research and development by the three types, basic, applied, and development. Definitions of "Federal," and of "Company and Other" are provided below, after the definitions of types and methods for estimating the breakdowns by type.

Types of Research – Breakdown the total reported in Item 5 into the categories shown below:

Item 5A – Basic Research – Include the cost of research projects which represent original investigation for the advancement of scientific knowledge and which do not have specific commercial objectives, although they may be in the fields of present or potential interest to the reporting company.

Item 5B1 – Applied Research – Include the cost of research projects which represent investigation directed to discovery of new scientific knowledge and which have specific commercial objectives with respect to either products or processes. Note that this definition of applied research differs from the definition of basic research chiefly in terms of the objectives of the reporting company.

Item 5B2 – Development – Include the cost of projects which represent technical activity concerned with nonroutine problems which are encountered in translating research findings or other general scientific knowledge into products or processes. Do not include routine technical services to customers or other items excluded from definition of research-development above.

Methods of Estimating Research and Development Expenditures by Type – Many of the companies in this survey have accounts they believe substantially meet the definitions used in this survey for basic research, applied research, and development. In most cases, companies have found it possible to allocate their own accounts to these categories.

If your company does not keep records that meet or can be allocated to these specific categories, there are two principal ways to reduce the task of providing the data requested.

1. Isolate the projects that clearly fall in the development category. If your company fabricates products, such development activity will include the design, construction, and testing of prototypes and models. Some defense contracts typically call for several test models. If your company's research and development frequently involves the development of a "process" as in chemicals and petroleum, such development activity would include operations beyond the bench scale, primarily the design and operations of pilot plants or semiworks.

2. Isolate the organizational units whose research and development can be readily classified. If a company has two or more laboratories, the expenditures of some of these laboratories may be all classified in one or another type of research and development on the basis of the function assigned to the laboratory. There are laboratories assigned only development type work. There are others engaged only in applied or basic research. If research and development work is done in production units as well as in various laboratories, the research and development work in the production units will generally be of a development type.

The separate classification of clearly identified development operations, particularly in the industries producing expensive prototypes, will greatly reduce the balance to be distributed. The distribution will have to be estimated on the basis of a review of individual projects or on the basis of other summaries of the work. Please use the definitions for basic, applied, and development, as given above. If, despite these instructions, you feel that you are unable to distribute your research and development expenditures into groupings approximating the categories requested, please write to the Census Bureau describing your accounts and indicating your special problems. The Bureau may be able to make or obtain some suggestions that will be helpful in completing the report form.

Types of Activity Included in Development – The design and operation of pilot plants or semi-works plants so long as the principal purposes are to obtain experience and to compile engineering and other data to be used in evaluating hypotheses, in writing product formulas or in establishing finished product specifications, in designing special equipment and structures required by a process, and in preparing operating instructions or manuals. The engineering activity required to advance the design of a product or a process to the point where it meets specific functional and economic requirements and can be turned over to manufacturing units. The design, construction, and testing of preproduction prototypes and models and "engineering follow-through" in the early production phase is included.

The development of designs for special manufacturing equipment and tools is included but tool making and tool tryout are not included. The preparation of reports, drawings, formulas, specifications, standard practice instructions or operating manuals, and other media for transmitting to operating units information obtained from the above activities is included. However, the production of detailed construction drawings or manufacturing blueprints is not included. The question, "When does development end and production begin?" is often asked. If the primary objective is to make further improvements on the product or process, then the work comes within the definition of research and development. If, on the other hand, the product or process is substantially "set," and the primary objective is to develop markets or to do preproduction planning, or to get the production process going smoothly, then the work is no longer research and development.

Source of Funds – A separate column in Item 5 is provided for each of the following:

Item 5, Column 2 – Federal – Include the cost of work done on research and development contracts or subcontracts, and research and development portions of procurement contracts and subcontracts during the year.

Do not include here, or elsewhere in the report, research and development contracts and the portions of procurement contracts that you subcontracted to other research and development organizations. To do so would cause duplication in the statistical totals derived from these reports.

Item 5, Column 3 – Company and Other – Include the cost of all company-sponsored research and development performed within the company. (Report company-sponsored research and development performed outside the company in Item 11.) Research and development is performed by a few manufacturing companies for others than the Federal Government. Such research and development should be included in this column.

In Item 5E, report the expected or estimated cost of company sponsored research and development that will be performed within the company during 1970

Item 6 – Company Research and Development Allowed as Indirect Costs of Federal Contracts – Enter in Item 6, the approximate amount of company-initiated research and development costs (included in Item 5C, Column 3) which was allowed as indirect costs of Federal contracts. These charges are allowed in accordance with ASPR Regulation 15.205 and the same regulation as used in NASA and other Federal contracts.

Item 7 – Cost or Contract Value of Research and Development Performed Within the Company by Major Type of Expense – The type of information requested here will be available for separate research and development organizational units or for companies with separate research and development accounts. It is not requested that special analyses be made of cost records where research and development and other functions are combined and if existing records do not yield estimates for this item, the item need not be completed. However, if most research and development is performed in units where summaries are regularly prepared by element of cost it should be possible to base the breakdown of research and development costs upon the records of such establishments.

For wages and salaries report the gross earnings paid in calendar year 1969 to employees engaged in research and development, including dismissal pay, paid bonuses, vacation and sick-leave pay, and compensation in kind, and prior to such deductions as employees' Social Security contributions, withholding taxes, group insurance, and savings bonds. (You should follow the definition of salaries and wages that is used for calculating the withholding tax.) Include salaries of officers in the research establishment(s), if a corporation; exclude payments to proprietor or partners, if an unincorporated concern. Exclude payments to members of armed forces and pensioners carried on your active payroll. (Scientists and engineers are defined on page 3 (Item 4).)

For materials and supplies, report the delivered cost for all purchased materials consumed, whether received from other companies, withdrawn from inventory, or received from other establishments of this company.

Item 7C – Materials and Supplies, and Item 7D – Other Costs may be combined if a separate figure cannot be obtained or reasonably estimated from present accounts.

Item 8 – Fields of Basic Research – The following definitions are supplied for fields included in the item:

Engineering – Includes aeronautical, astronautical, chemical, civil, electrical, and mechanical engineering, and metallurgy and materials.

Geological sciences – Includes geodesy, hydrology, geochemistry, seismology, soil sciences, etc.

Atmospheric sciences – Includes aeronomy, weather modification, meteorology, etc.

Biological sciences – All sciences, other than clinical medical sciences, which deal with life processes, including plant and animal sciences, bacteriology, pathology, microbiology, pharmacology, etc.

Clinical medical sciences – All sciences concerned with the use of scientific knowledge for the identification, treatment, and cure of disease. Includes internal medicine, neurology, preventive medicine and public health, psychiatry, dentistry, pharmacy, etc.

Other sciences – To be used for multidisciplinary and interdisciplinary projects which cannot be classified within one of the above primary fields of science.

Item 9 – Applied Research and Development by Product Group – Enter both Federal and total costs of Applied Research and Development by product group. Costs should be entered in the field or product group in which the research and development project was actually carried on regardless of the classification of the field of manufacturing in which the results are to be used. For example, research on an electrical component for a farm machine should be reported as research on electrical machinery. Also, research on refractory bricks to be used by the steel industry should be reported as research on stone, clay, glass, and concrete products rather than primary ferrous metals, whether performed in the steel industry or the stone, clay, glass, and concrete industry. Research and development work on an automotive head lamp would be classified in Group 25, regardless of whether performed by an automotive or electrical company. Fields of Applied Research and Development are listed below. For those companies familiar with the Standard Industrial Classification, the 1967 SIC number or numbers are given after each title. Note, however, that the SIC definition here applies to the field of research and development effort, and not necessarily to the field in which your company's manufacturing output is classified.

Product Group

1 **Atomic Energy Devices** – Applied Research and Development on atomic energy devices, previously reported separately, should be included with research and development as classified in the categories listed on lines 2–33. Examples of the fields of research and development activities on atomic energy devices and the product groups in which such activities should be reported are as follows:

Activity	Product group No.
Radioactive isotopes and other radiation sources	4
Partially fabricated reactor fuel element materials and control rods.	12
Nuclear reactors	14
Reactor components and equipment	
Core structurals (barrels, cans, boxes, plates, etc.)	
Heat exchangers and condensers	
Valves	
Complete reactor fuel elements and control rods for use in:	
Propulsions	
Power plants	
Other	
Atomic waste casks	
Fuel handling equipment	20
Control rod drive mechanism and components for:	
Power plants	
Propulsions	
Other	
Pressurizers, components and auxiliary equipment	
Pumps	
Accessory instrumentation for reactor control	22
Atom smashers (particle accelerators) . . .	24
Hot laboratory equipment	31
Special instrumentation	

2 **Foods and Kindred Products (SIC 20)** – Foods and beverages for human consumption and certain related products, such as vegetable and animal fats and oils, prepared feeds for animals and fowls.

3 **Textile Mill Products (SIC 22)** – Mill preparation of fibers and mill manufacture of yarn, thread, braids, twine, and cordage; manufacture of broad and narrow woven fabric, knit fabric, carpets and rugs from yarn; dyeing and finishing fiber, yarn, and knit apparel; coating, waterproofing, or otherwise treating fabric; the integrated manufacture of knit apparel and other finished articles from yarn; the manufacture of felt goods, lace goods, bonded fiber fabrics, and miscellaneous textiles.

4.**Basic Industrial Inorganic and Organic Chemicals (SIC 281).** Includes radioactive isotopes and other radiation sources.

5 **Plastics Materials and Synthetic Resins, Synthetic Rubber, Synthetic and Other man-made Fibers except glass (SIC 282)** – Exclude glass.

6 **Drugs (SIC 283)** – Medicinal Chemicals, biological and botanical products, and pharmaceutical preparations.

7 **Agricultural Chemicals (SIC 287)** – Fertilizers, agricultural pesticides, and other agricultural chemicals.

8 **All other Chemicals (Balance of SIC 28)** – Explosives, soaps, glycerins, detergents and cleaning preparations, paints and varnishes, toilet preparations, and miscellaneous chemical products.

9 **Petroleum Refining and Extraction, and Natural Gas (SIC 13 and 29)** – Exclude geological and geophysical exploration activities.

10 **Rubber and Miscellaneous Plastics Products (SIC 30)** – Fabricated rubber such as industrial and mechanical rubber goods and fabricated plastics products.

11 **Stone, Clay, Glass, and Concrete Products (SIC 32)** – Ceramics, glass, clay products, abrasives and asbestos products, cement, stone products, concrete products, and other non-metallic mineral products.

12 **Primary Ferrous Products (SIC 331, 332, 3391, and 3399)** – Products of blast furnaces, steel works, rolling and finishing mills, iron and steel castings and forgings. Includes partially fabricated reactor fuel element materials and control rods.

13 **Primary and Secondary Nonferrous Metals (Balance of SIC 33)** – Primary and secondary smelting and refining of nonferrous metals; rolled, drawn, and extruded nonferrous metal products, castings and forgings.

14 **Fabricated Metal Products (SIC 34)** – Tinware, hand tools, non-electric heating apparatus, fabricated structural metal products, metal stampings, fabricated wire products, etc. Includes: nuclear reactors; reactor components and equipment; core structurals (barrels, cans, boxes, plates, etc.); heat exchangers and condensers; valves; complete reactor fuel elements and control rods for use in: propulsions, power plants, and other systems; atomic waste casks.

15 **Engines and Turbines (SIC 351)** – Steam engines, steam, gas and hydraulic turbines, diesel and other internal combustion engines, n.e.c.

16 **Farm Machinery and Equipment (SIC 352)** – Farm machinery, including tractors for farm use.

17 **Construction, Mining, and Material Handling Machinery and Equipment (SIC 353)** – Construction, mining, and oil field machinery and equipment, elevators, conveyors, hoists, industrial trucks, tractors, trailers and stackers.

18 **Metalworking Machinery and Equipment (SIC 354)**– Machine tools, dies, machine tool accessories, rolling mill machinery, power driven hand tools, wire fabricating machinery and equipment, and automobile maintenance machinery and equipment.

19 **Office, Computing, and Accounting Machines (SIC 357)** – Typewriters; electronic computing equipment; calculating and accounting machines; scales and balances (except laboratory); and other computing and office machines.

20 **Other Machinery, Except Electrical (Balance of SIC 35)** – Special industrial machinery, except metalworking, such as food products machinery, textile and paper industries machinery, general industrial machinery and equipment, and miscellaneous machinery except electrical. Includes atomic fuel handling equipment; control rod drive mechanism and components for: power plant, propulsions; pressurizers, components and auxiliary equipment; pumps.

21 **Electric Transmission and Distribution Equipment (SIC 361)** – Electric measuring instruments and test equipment, power, distribution and specialty transformers, switchgear and switchboard transformers, etc.

22 **Electrical Industrial Apparatus (SIC 362)** – Electric motors and generators, motor starters and controls, welding apparatus, carbon and graphite brushes, electrodes, capacitors, condensors, and rectifiers. Includes accessory instrumentation for reactor control.

23 **Radio and Television Receiving Sets, Except Communication Types (SIC 365)** – Radio and television receiving sets, except communication types and phonograph records.

24 **Electronic Components and Accessories, Communications Equipment (SIC 366–67)** – Electron tubes, cathode ray tubes, resistors-capacitors, transformers and other components for electronic end products, solid state electronic devices, and telephone and telegraph apparatus. Also includes electronic guidance control sub-assemblies, radar and radio equipment, and electronic sighting devices. Includes atom smashers (particle accelerators).

25 **Other Electrical Machinery Equipment and Supplies (Balance of SIC 36)** – Household appliances, electric lighting and wiring equipment, and miscellaneous electrical machinery equipment and supplies.

26 **Missiles (SIC 192)** – Including frames or structures, launching and handling support equipment and work on the missile system as a whole. Electronic guidance control sub-assemblies and radar should be included in Group 24 above. Rocket motors should be included in Group 28 below.

27 **Space Vehicles (SIC 192)** – Including frames or structures, launching and handling support equipment and work on the space vehicle as a whole.

28 **Aircraft and Parts (SIC 372)** – Piloted and unpiloted aircraft and parts of all types, including engines and auxiliary equipment such as landing gear, deicing equipment, turrets and turret drives, and other auxiliary equipment specifically adopted for aircraft. Radar and radio equipment and electronic sighting devices should be included in Group 24 above. Aeronautical instruments should be included in Group 31 below.

29 **Motor Vehicles and Equipment (SIC 371)** – Applied research and development related to motor vehicles, including automobiles, trucks, busses, and special purpose motor vehicles such as ambulances, fire engines, personnel carriers, amphibian motor vehicles, and truck and automobile trailers, and to motor vehicle equipment and parts (exclude batteries, tires, engine electrical equipment, etc.).

30 **Other Transportation Equipment (Balance of SIC 37)** – Ship and boat building and repairing, railroad equipment, motorcycles, bicycles and parts, etc.

31 **Professional Scientific and Controlling Instruments, Photographic and Optical Goods; Watches and Clocks (SIC 38)** – Engineering, laboratory, and scientific and research instruments, instruments for measuring, controlling and indicating physical characteristics. Optical instruments and lenses, surgical, medical, and dental instruments; fire control apparatus; ophthalmic goods, photographic equipment; and watches, clocks, etc. Includes hot laboratory equipment, and special instrumentation.

32 **Ordnance, Except Missiles (balance of SIC 19)** – Artillery, small arms, ammunition, tanks, and parts, etc.

Item 10 – Cost of Research and Development Performed Within the Company, by State – List the States in which your research and development laboratories or facilities are located and report the cost of research and development for each State. It is not intended that information reported reflect individual assignments outside the home State of the particular research staff. As much as 10 percent of the total may, if desired, be reported as "Not distributed by State."

Section III – RESEARCH AND DEVELOPMENT PERFORMED OUTSIDE THE COMPANY

Item 11 – Total Company Funds Spent for Research and Development Activities Performed Outside the Company Within the United States – Report the amount of company funds spent for research and development performed outside of the company within the United States. This item includes contracts to outside organizations, but specifically excludes subcontracting of Federal Government or other company contracts.

RD-1
(4-70)

U.S. DEPARTMENT OF COMMERCE
Bureau of the Census
Washington, D.C. 20233

RD-1 Supplementary Instruction Sheet, 1969

Figures from your 1968 report have been entered in red in the 1968 columns of the present form.

Selected 1968 data not preposted	The 1968 entry for one or more items on a form may be omitted. If, from our editing, we judged an entry to be incorrect, due to rounding, bracketing, unusual relationship with other items, etc., it was changed in our machine editing. Such items have not been preposted. In such cases, please compare with your 1968 file copy, enter the correct 1968 data, or confirm the original figure. Write us if you have any questions.
Bracketed items	Do not bracket items. Please use reasonably accurate estimates to report detail, where necessary.
Particularly Lines 23 and 24, Item 9	Note Item 9, lines 23, "Radio and television receiving sets, except communication types," and 24, "Electronic components and accessories, communications equipment." These two items were combined through 1967. If you perform research and development in these fields, please report these items separately for both 1968 and 1969. We incorrectly preposted the combined figure when last year's form was mailed to you. Therefore, no 1968 data have been preposted for these items although the combined amount is included in the Item 9 total for 1968.

☆ U.S. GOVERNMENT PRINTING OFFICE: O—423-367

National Science Foundation
Washington, D.C. 20550

Official Business
PENALTY FOR PRIVATE USE, $300

Postage and Fees Paid
National Science Foundation

U.S.MAIL

[redacted]